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SOIL INVENTORY of the BENTON-OWENS VALLEY AREA

Inyo and Mono Counties, California

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SOIL INVENTORY OF THE BENTON-OWENS VALLEY AREA PARTS OF INYO AND MONO COUNTIES, CALIFORNIA

by Daniel E. Vaughn
Interpretive tables compiled by Daniel C. Cressy

Fieldwork by Daniel C. Cressy, Daniel E. Vaughn, Corey Unfried, Carol A. Kennedy, Gregory J. Rieder, Mary B. Gundert, Chris Norris, Christine Turner, John W. Key, V., and James C. Wardlaw. Only lands administered by the Bureau of Land Management were inventoried. Cartographic work and illustrations completed by the Cartographic Services Unit, BLM, Sacramento. Interpretive tables typed by the Information Services Branch, Division of Administration, BLM, Sacramento.

This is a publication of the U.S. Department of the Interior, Bureau of Land Management. It is an interim report which was conducted in accordance with the procedures and standards of the National Cooperative Soil Survey, and may be incorporated in an official National Cooperative Soil Survey publication by the U.S. Department of Agriculture, Soil Conservation Service at a later date. Major fieldwork for this soil inventory was completed during 1977 - 1980. Unless otherwise indicated, statements in the publication refer to conditions in the area in 1980. New soil series were approved in 1983 by Terry Cook, State Correlator, SCS, Davis. Other soil names and mapping unit names were approved in 1983 by Mario Valverde, Area Soil Specialist, SCS, Fresno.

Soil maps in this inventory report may be copied without permission, but any enlargement of these maps can cause misunderstandings of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger scale. Also, on-site investigations should be conducted when determining the soils on small tracts of land (less than 20 acres in size).

Cover photo: Granite Mountain, southeast of Mono Lake.

HOW TO USE THIS SOIL INVENTORY

This soil inventory contains information that can be applied in managing rangeland, water resources, wildlife, woodland, recreation, and other uses which may involve soils.

Locating Soils Information

All the soils in the Benton-Owens Valley Area are shown on the detailed maps in the map folder that accompanies this publication. Each map sheet is numbered to correspond with a number on the Index to Map Sheets. Locate the area you want on the Index to Map Sheets and then refer to the detailed map that covers that area.

On each sheet of the detailed map, soil areas are outlined and are identified by a three-digit symbol, such as "118". All areas marked with the same symbol are the same kind of soil(s). The soil symbol is inside the area if there is enough room on the map; otherwise it is outside and a pointer shows where the symbol belongs.

Now go to the section entitled Soil Mapping Unit Descriptions and turn to the number of the description that corresponds to the number on the area in question, such as "118". This description tells about the soil(s) in that mapping unit. For more information on each soil, turn to the section entitled "Use and Management of the Soils".

General Soil Map:

The general soil map in the map folder is to be used for broad planning or to get a general view of the soils in the area. It is used in the same way as the detailed map, except that each numbered map unit, such as "1A", has its own written description under the section "General Soil Map Units".

CONTENTS

LOCATION of the BENTON-OWENS VALLEY AREA in California

Figure 1

INTRODUCTION TO THE AREA

INTRODUCTION TO THE AREA

The Benton-Owens Valley Area is in east-central California about 250 miles north of Los Angeles and 200 miles east of San Francisco. The area represents a transition zone between the Great Basin to the north and the Mojave Desert to the south and east. It is bounded by the Sierra Nevada Range to the west and the Inyo-White Mountains to the east. Owens Valley has been called the nation's deepest valley, which is apparent after viewing the high mountains on either side. It is a long, north-south trending trough about 80 miles long and 5 to 12 miles wide. Differences in elevation within the survey area are considerable with a low of 3,600 feet at Owens Dry Lake to a high of 11,107 feet at Mount Inyo, only 13 miles away. The area has 254,440 acres in Inyo County and 299,180 acres in Mono County, for a total acreage of 553,620 acres in the area. Bishop is the largest town in the area with a population of about 10,000. Other towns are Lone Pine, Independence, Lee Vining, Crowley Lake, Olancha, Keeler, and Benton. Tourism and livestock grazing are the economic backbone of the area. Agriculture used to be an important industry, but land acquisitions and water diversions by the Los Angeles Department of Water and Power since the turn of the century have diminished the importance of this industry.

The Benton-Owens Valley Area is characterized by basin and range topography. It is dominated by the Owens Valley in the southern half of the area and by a series of low mountains and high valleys in the northern half. Starting from the southern boundary near Olancha, the dry lakebed of Owens Lake is very noticeable. It is the lowest point in the survey area (3,600 feet) and has no outlet. The Owens River, which drains most of the survey area, has this lakebed as its final destination. However, water diversions by the Los Angeles Department of Water and Power have greatly reduced its flow from the perennial streams which drain the eastern escarpment of the Sierra Nevada. The floor of Owens Valley ((3,600-4,100 feet) is a nearly level former floodplain of the Owens River. The crest of the Inyo Mountains ranges from 9,000 to 11,100 feet in elevation. The crest of the Sierra Nevada, which is outside the actual survey area, is 11,000 to 14,500 feet in elevation. Some small hills project through the floor of the valley - the Alabama Hills near Lone Pine, and the Poverty Hills and a few small cinder cones near Big Pine. North of Bishop is an extensive area of volcanic ash flows called the Volcanic Tablelands. These slope gently upward (4,000-6,000 feet) toward the Benton Range. Between Bishop and Benton are a series of small valleys (Chalfant, Hammil, and Benton) bordered on the east by an apron of alluvial fans from the rugged White Mountains (12,000 - 14,200 feet). West of Benton Valley (5,400 feet) is another portion of the Benton Range followed by the large, high altitude Adobe Valley (6,400 feet). West of Adobe Valley is a series of low mountains dominated by sharp Granite Mountain (8,874 feet). Bowl-shaped Mono Basin (6,400 feet-7,200 feet) lies west of these mountains and just east of the Sierra Nevada escarpment. This basin contains the large-but-shrinking Mono Lake, another saline lake with no outlet that is fed by Sierran snowmelt. The only perennial streams in the area occur on the alluvial fans at the base of the Sierra Nevada. The Benton Range, Cowtrack Mountain, and Inyo-White Mountains rarely produce any surface runoff. Three main drainage sinks are present, with no outlet to the Pacific Ocean. These sinks are Owens Dry Lake, Mono Lake and the intermittent lakes on the floor of Adobe Valley.

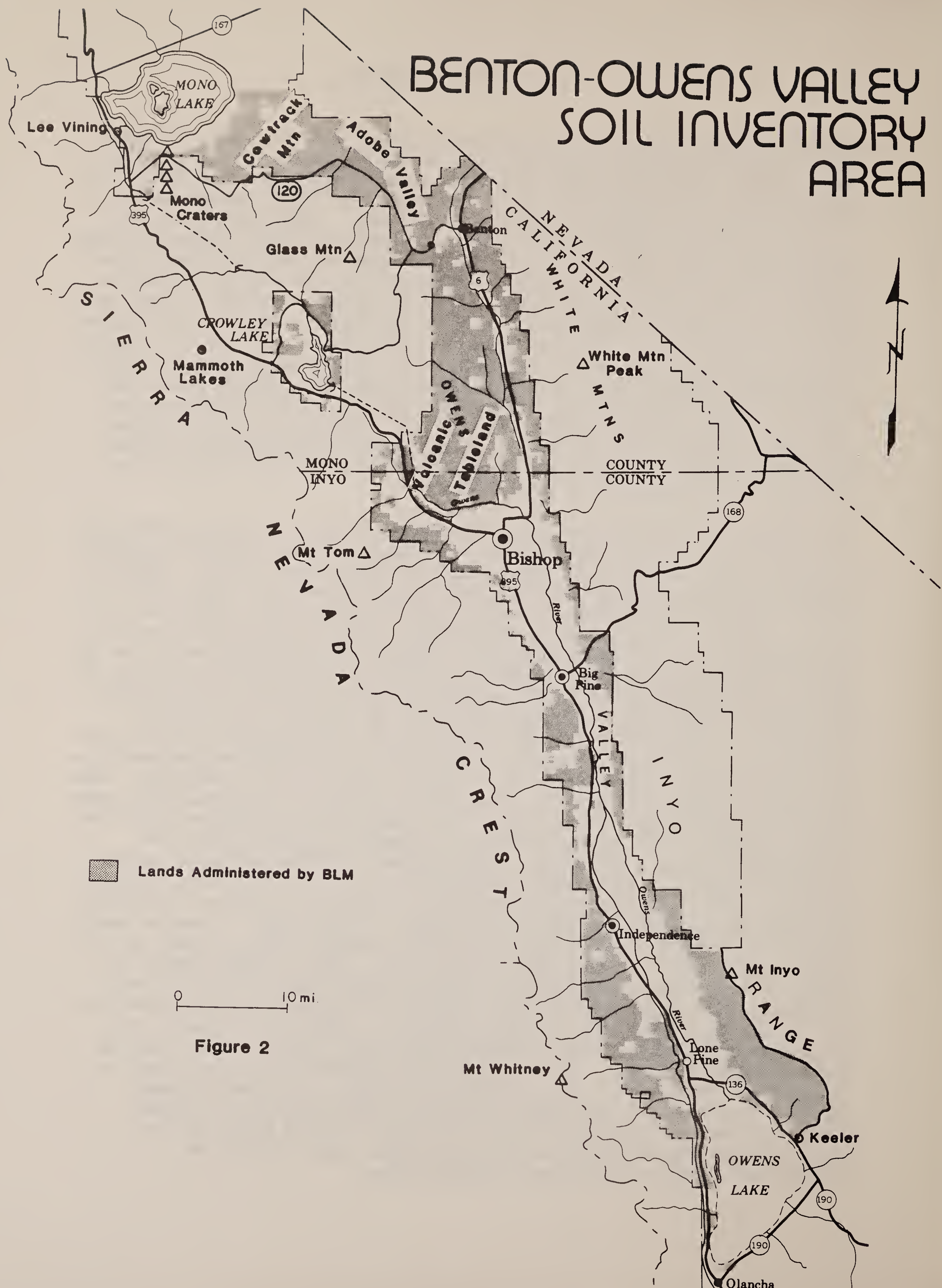

BENTON-OWENS VALLEY SOIL INVENTORY AREA
MONO LAKE
Lee Vining
Cowtrack Mtn
Adobe Valley
Mono Craters
120
395
167
Benton
NEVADA
CALIFORNIA
Glass Mtn
6
WHITE MTNS
SIERRA
CROWLEY LAKE
Mammoth Lakes
White Mtn Peak
OWENS
Volcanic Tableland
MONO
INYO
COUNTY
COUNTY
168
Owens
Bishop
Mt Tom
NEVADA
395
River
Big Pine
VALLEY
CREST
INYO
Owens
Independence
Mt Inyo
RANGE
River
Lone Pine
Mt Whitney
136
Keeler
OWENS
LAKE
190
190
Olancha
Lands Administered by BLM
0
10 mi

Figure 2

INDEX TO SOIL MAPPING UNITS

INDEX TO SOIL MAPPING UNITS

Symbol	Soil Mapping Unit Name	Acres
120	Cowtrack Variant gravelly coarse sand, 0 to 9 percent slopes	1,570
121	Cryoborolls, extremely gravelly, 15 to 50 percent slopes	1,000
122	Cryoborolls, bouldery - Rock outcrop complex, 15 to 50 percent slopes	1,700
123	Durargids, shallow, 2 to 9 percent slopes	1,390
124	Entic Durorthids - Typic Durorthids complex, cool, 5 to 50 percent slopes	11,990
125	Pajuela very bouldery loamy coarse sand, 5 to 15 percent slopes	11,310
126	Pajuela - Thibau complex, 5 to 15 percent slopes	16,660
127	Halloran Variant very gravelly sand, 2 to 5 percent slopes	490
128	Hammil gravelly loamy sand, 0 to 5 percent slopes	11,280
129	Haplargids - Torriorthents complex, frigid, 15 to 50 percent slopes	3,730
130	Honova very cobbly loamy sand, 0 to 9 percent slopes	49,840
131	Honova Variant loamy coarse sand, 2 to 9 percent slopes	840
132	Hoye Variant loam, 0 to 2 percent slopes	1,010
133	Wellington* very gravelly loamy sand, moist, 2 to 9 percent slopes	2,750
134	Wellington* very gravelly loamy sand, dry, 2 to 9 percent slopes	2,060
135	Lithic Torriorthents - Lithic Haplargids - Rock outcrop complex, thermic, 30 to 75 percent slopes	47,130
136	Lithic Xerollic Haplargids - Lithic Xeric Torriorthents complex, mesic, 30 to 75 percent slopes	23,270
137	Haar family soils, 2 to 15 percent slopes	3,730
138	Xeric Torriorthents, very bouldery - Rock outcrop complex, 15 to 50 percent slopes	15,400
139	Millner association, 5 to 15 percent slopes	13,880

Symbol	Soil Mapping Unit Name	Acres
140	Dotard* very gravelly sandy loam, 5 to 15 percent slopes	1,760
141	Pizona - Brantel association, 2 to 50 percent slopes	15,520
142	Avalmount - Rock outcrop complex, 5 to 30 percent slopes	2,240
143	Playa	3,750
144	Rock outcrop	4,430
145	Rovana gravelly loamy coarse sand, 5 to 15 percent slopes	1,040
146	Rovana loamy sand, 0 to 5 percent slopes	4,590
147	Sawavu - Brantel complex, 2 to 9 percent slopes	15,830
148	Sherwin very cobbly loamy fine sand, 5 to 15 percent slopes	5,420
149	Taboose - Rock outcrop complex, 5 to 30 percent slopes	9,690
150	Taboose* - Rock outcrop complex, 5 to 15 percent slopes	1,950
151	Thibau loamy coarse sand, 5 to 15 percent slopes	4,390
152	Thibau gravelly loamy coarse sand, 15 to 30 percent slopes	1,600
153	Tinemaha very bouldery loamy coarse sand, 5 to 15 percent slopes	5,890
154	Tinemaha - Lubkin complex, 5 to 15 percent slopes	13,370
155	Xeralfic Haplargids, mesic, 5 to 30 percent slopes	1,670
156	Lithic Xeric Torriorthents - Buscones complex, 15 to 50 percent slopes	7,060
157	Torriorthents - Haplargids - Rock outcrop complex, frigid, 15 to 50 percent slopes	2,410
158	Torripsamments - Cinder land association, 15 to 50 percent slopes	1,140
159	Tuttle very bouldery loamy coarse sand, dry, 5 to 15 percent slopes	1,960
160	Tuttle very bouldery loamy coarse sand, moist, 5 to 15 percent slopes	6,560

Symbol	Soil Mapping Unit Name	Acres
161	Tuttle - Rovana complex, dry, 5 to 15 percent slopes	9,980
162	Tuttle - Rovana complex, moist, 5 to 15 percent slopes	4,240
163	Tuttle Variant sandy loam, 0 to 5 percent slopes	1,590
164	Victorville - Villa families complex, 0 to 2 percent slopes	5,900
165	Water	210
166	Whitewolf - Toquerville families association, 15 to 50 percent slopes	7,090
167	Xeric Torriorthents, 0 to 9 percent slopes	1,830
168	Xeric Torriorthents, sodic, 0 to 9 percent slopes	1,170
169	Xeric Torriorthents, ashy - Durorthids, ashy complex, 0 to 2 percent slopes	1,250
170	Xerollic Durorthids, 2 to 9 percent slopes	2,010
171	Yellowrock sand, 0 to 5 percent slopes	1,970
172	Yellowrock - Seaman complex, 2 to 5 percent slopes	3,720
173	Yermo extremely gravelly sandy loam, 2 to 5 percent slopes	2,500
174	Yermo association, 5 to 15 percent slopes	8,790
175	Zono coarse sand, 15 to 50 percent slopes	14,370
176	Honova Variant - Rock outcrop complex, 2 to 9 percent slopes	1,510
177	Yermo association, cool, 5 to 15 percent slopes	9,590
178	Entic Durorthids - Typic Durorthids complex, warm, 5 to 50 percent slopes	1,830
	TOTAL	553,620

* Taxadjunct to the series

SOIL MAPPING UNIT DESCRIPTIONS

SOIL MAPPING UNIT DESCRIPTIONS

The kinds of soil (mapping units) shown on the more detailed soil maps in the map folder are described in this section. These descriptions together with the soil maps can be useful in determining the potential of a soil; in planning land use and developing soil resources; in managing it for food and fiber production; and in enhancing, protecting, and preserving the environment. More information for each mapping unit is given in the section entitled "Use and Management of the Soils".

A soil mapping unit represents an area on the landscape and consists mostly of the soil or soils for which the unit is named. Most mapping units are made up of one phase of a soil series. For example, "Brantel gravelly loamy sand, 0 to 5 percent slopes" is one of several phases within the Brantel series. Some mapping units are made up of two or more dominant kinds of soil. These are called complexes or associations. Several such kinds of mapping units are shown on the soil maps of this inventory area.

Most mapping units include small, scattered areas of soils or miscellaneous areas (inclusions) other than those that appear in the name of the mapping unit. Some of these have properties that differ substantially from those of the dominant soil or soils, and thus could significantly affect the use and management of the mapping unit. Therefore, on-site investigations should be conducted when determining the soils on small tracts of land (less than 20 acres in size). These inclusions within mapping units are stated in the description of each mapping unit. Some of the more unusual or strongly contrasting inclusions are identified by a special symbol (spot symbol) on the soil maps.

The acreage of each mapping unit is given in the "Index to Soil Mapping Units" in the preceding section. Many of the terms used in describing soils are defined in the Glossary.

Note: "bare soil conditions" as used in the erosion statements of these mapping unit descriptions is defined as a soil that has been stripped of vegetation, without significant soil compaction or disturbance.

101 - Alamedawell - Deepwell complex, 2 to 15 percent slopes

Taxonomic Class:
Ashy over loamy, mixed (calcareous), mesic Xeric Torriorthents (Alamedawell)
Ashy, mesic Xeric Torripsamments (Deepwell)

Setting:
This mapping unit is on broad lake terraces on the east side of Mono Lake. The topography is undulating to rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,400 to 6,900 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 50 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Alamedawell soils and 20 percent Deepwell soils. The Alamedawell soil is in the interdune areas with slopes of 2 to 9 percent, and the Deepwell soil is on the stabilized sand dunes and sandy ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Brantel loamy sand on nearly level areas, soils with loamy sediments at a depth of 10 to 30 inches or at a depth of 40 to 60 inches, loamy soils that lack an ashy overburden, soils with layers of hard tufa in the lower layers, unstabilized sand dunes, badland, and soils with slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Alamedawell soil is very deep and somewhat excessively drained. It formed in eolian and airfall deposits of rhyolitic volcanic ash over old lakebed sediments from mixed rock sources. Typically, the surface layer is light gray loamy sand about 3 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light gray loamy sand about 29 inches thick. The next layers to a depth of 60 inches or more are stratified loam, silt loam, and sand. These lakebed sediments are firm and are very slightly cemented by calcium carbonate. Depth to the lakebed sediments ranges from 30 to 40 inches. The soil above the sediments contains 5 to 10 percent fine and medium pumice gravel.

The Deepwell soil is very deep and somewhat excessively drained. It formed in well sorted, windblown deposits of rhyolitic volcanic ash. Typically, the soil is light gray sand to a depth of 60 inches or more. The surface 2 or 3 inches has loose consistency. In some areas, the soil texture is fine sand.

Properties:
Permeability of the Alamedawell soil is rapid (6-20 in/hr) to a depth of 30 to 40 inches, and moderately slow (0.2-0.6 in/hr) below this depth. Available water capacity is moderate (5.0-7.5 in). The effective rooting

depth is 30 to 40 inches. The soil is calcareous below a depth of 3 to 10 inches. The soil reaction is moderately alkaline (pH 7.4-7.8) in the ashy overburden and strongly alkaline (pH 8.5-9.0) in the lakebed sediments. The ashy overburden is nonsaline and nonsodic. For the lakebed sediments, the electrical conductivity of the saturation extract is less than 2 and the exchangeable sodium percentage is 15 to 30. The organic carbon content is less than 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Deepwell soil is rapid (6-20 in/hr). Available water capacity is moderate (5.0-7.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous. The soil reaction is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is less than 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is high under native conditions and very high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on the Alamedawell soil is mainly:

Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	30%
big sagebrush (*Artemisia tridentata*)	20%
black greasewood (*Sarcobatus vermiculatus*)	5%
gray horsebrush (*Tetradymia canescens*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
common pricklygilia (*Leptodactylon pungens*)	5%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	5%
annual forbs	5%
Nevada dalea (*Dalea polyadenia*)	2%
little horsebrush (*Tetradymia glabrata*)	2%
needle-and-thread grass (*Stipa comata*)	2%
inland saltgrass (*Distichlis stricta*)	2%
Utah juniper (*Juniperus osteosperma*)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface.
Range site name: Alkali ashy sand 10-12" p.z. (CA-26-33)

The potential plant community on the Deepwell soil is mainly:

black greasewood (*Sarcobatus vermiculatus*)	20%
big sagebrush (*Artemisia tridentata*)	15%
hairy horsebrush (*Tetradymia comosa*)	15%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%

Douglas rabbitbrush (Chrysothamnus viscidiflorus)	8%
fourwing saltbush (Atriplex canescens)	5%
spiny hopsage (Grayia spinosa)	5%
inland saltgrass (Distichlis stricta)	2%
little horsebrush (Tetradymia glabrata)	2%
perennial forbs	2%
annual forbs	2%

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface.
Range site name: Alkali ashy sand 10-12" p.z. (CA-26-33)

This unit is poorly suited to rangeland seeding due to the sandy textures and low precipitation. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.

Plate 1. Unit 101 in eastern Mono Basin. Note the hummocky character of the Deepwell soils. Looking southwest toward the Sierra Nevada.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the hazard of soil blowing. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the slowly permeable lakebed sediments. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. If the Alamedawell soil is used for septic tank absorption fields, the limitation of slow substratum permeability can be overcome by longer absorption lines and the use of sandy backfill in the trenches. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capacity subclass VIe (26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the sandy textures, uneven topography, short growing season, and the hazard of soil blowing.

102 - Aquic Torriorthents - Aquents complex, 0 to 2 percent slopes

Taxonomic Class:
Aquic Torriorthents
Aquents

Setting:
This mapping unit is on nearly level valley floors. The native vegetation is mainly moisture-loving perennial grasses, with some salt and sodium-tolerant shrubs and grasses. Elevation is 6,400 to 7,000 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A one to three-foot mantle of snow may cover this unit for brief to extended periods. Mean annual snowfall is 50 to 80 inches. Some summer thundershowers occur, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Aquic Torriorthents and 20 percent Aquents. The Aquic Torriorthents occur on slightly higher areas where the water table stays below 3 feet at all times. The Aquents occur in the lowest areas of the unit and have standing water at or near the surface in the spring. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the named soils but lacking a saline or alkaline surface layer, Aquic Torrifluvents, Aquic Torripsamments, Brantel soils, Deepwell soils, Brantel Variant soils, areas of playa that are devoid of vegetation, and soils with shallow, platy, tufa hardpans (Durorthids) near Mono Lake. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Aquic Torriorthents are very deep and somewhat poorly drained. They formed in alluvium derived dominantly from rhyolitic volcanic ash and mixed

rock sources. The surface layers are loam, sand, sandy loam, or loamy sand. A thin, white salt crust is on the surface in summer and fall. The lower layer to a depth of 60 inches or more is stratified silt loam, sandy loam, coarse sand, loamy sand, and gravelly sand. The soil contains 0 to 15 percent rock fragments consisting of fine and medium pumice gravel.

The Aquents are very deep and are poorly or very poorly drained. They formed in alluvium derived dominantly from rhyolitic volcanic ash and mixed rock sources. The surface layers are sandy loam, loam, or loamy sand. A thin, white salt crust is on the surface in summer and fall. The next layer to a depth of 60 inches or more is stratified coarse sand, loamy sand, sandy loam, silt loam, and silty clay loam. The soil contains 0 to 5 percent fine and medium pumice gravel.

Properties:

Permeability of the Aquic Torriorthents is moderate (0.6-2.0 in/hr) above the water table. A seasonal high water table comes up to a depth of 3 to 5 feet in the spring and summer. Around Mono Lake the water table is fed by freshwater springs which surface at the edge of the lake. Available water capacity is low to high (4-8 in). Effective rooting depth is 36 to 60 inches. The soil reaction in the surface layer is moderately to very strongly alkaline (pH 7.8-10.0); in the lower layers, it is neutral to strongly alkaline (pH 7.0-9.0). For the surface layer, the electrical conductivity of the saturation extract is 2.0 to 20 mmhos/cm and the exchangeable sodium percentage is 5 to 20 percent. The lower layer is typically nonsaline-nonsodic. Salinity and alkalinity of the surface layer increase during fall as salts accumulate on the soil surface. The organic carbon content is less than 0.6 percent. Runoff is very slow or ponded. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low when the soil surface is moist and moderate when dry and bare.

Permeability of the Aquents is moderately slow (0.2-0.6 in/hr) above the water table. A seasonal high water table is at a depth of 0 to 24 inches in the spring and summer. The whole profile is saturated for at least a few days in the spring. Around Mono Lake the water table is fed by fresh- water springs which surface at the edge of the lake. Available water capacity is low to high (4-8 in.). Effective rooting depth is at least 60 inches for water-tolerant plants but is limited to depths between 5 and 30 inches for plants that are not water-tolerant. The soil is calcareous in the surface layer. The soil reaction in the surface layer is moderately to very strongly alkaline (pH 7.8-10.0); in the lower layers, it is neutral to moderately alkaline (pH 7.0-8.4). For the surface layer, the electrical conductivity of the saturation extract is 2 to 20 mmhos/cm and the percentage of exchangeable sodium is 15 to 50 percent. The lower layer is typically nonsaline-nonsodic. Salinity and alkalinity of the surface layer increase during fall as salts accumulate on the soil surface. The organic carbon content is less than 0.6 percent. Runoff is very slow or ponded. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low when the soil surface is moist and moderate when dry and bare. In windy weather this unit receives saline dust from nearby playas.

Use:

At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on the Aquic Torriorthents is mainly:

inland saltgrass (Distichlis stricta)	40%
rubber rabbitbrush (Chrysothamnus nauseosus)	15%
black greasewood (Sarcobatus vermiculatus)	10%
annual forbs	10%
basin wildrye (Elymus cinereus)	5%

The annual production of air-dry vegetation is 600 to 1,000 pounds per acre. Vegetation covers 5 to 20 percent of the soil surface.
Range site name: Alkali wet meadow 8-12" p.z. (CA-26-32)

The potential plant community on the Aquents is mainly:

inland saltgrass (Distichlis strieta)	25%
alkali sacaton (Sporobolus airoides)	20%
Nevada bluegrass (Poa nevadensis)	20%
sedges (Carex sp.)	5%

The annual production of air-dry vegetation ranges from 800 to 1,600 pounds per acre. Vegetation covers 20 to 80 percent of the soil surface.
Range site name: Alkali wet meadow 8-12" p.z. (CA-26-32)

This unit is poorly suited for rangeland seeding due to the saline-sodic surface layer in most areas. This unit has a moderate to severe limitation for fencing due to potential wetness, ponding, and excess salts.

Plate 2. Unit 102 in Adobe Valley. Antelope Mountain in cloud shadow. Looking southeast toward the White Mountains.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the high water table and saline-sodic surface layer. The soils have high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the high water table and saline-sodic surface layer. Drainage is needed if improved roads and building foundations are constructed. Sulfate-resistant concrete should be used in any construction project. The high water table increases the possibility of failure of septic tank absorption fields.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the high water table.

103 - Aquic Torriorthents - Aquents - Deepwell complex, 0 to 15 percent slopes

Taxonomic Class:
Aquic Ustorthents
Aquents
Ashy, mesic Xeric Torripsamments (Deepwell)

Setting:
This mapping unit is on low spots on valley floors. Slopes are nearly level with some rolling sand dunes. The native vegetation is moisture-loving perennial grasses, with some salt and sodium-tolerant shrubs and grasses. Elevation is 6,400 to 7,000 feet. The mean annual precipitation is 9 to 11 inches, the mean annual air temperature is 45 to 48°F, and the mean 32° frost-free season is about 125 days. A one to two-foot mantle of snow may cover this unit for brief periods. Mean annual snowfall is about 50 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 40 percent Aquic Torriorthents, 20 percent Aquents, and 20 percent Deepwell soils. The Aquents and Aquic Torriorthents are on the nearly level interdune areas, and the Deepwell soil is on stabilized sand dunes with slopes of 2 to 15 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the wet soils but lacking a saline or alkaline surface layer, Aquic Torrifluvents, Aquic Torripsamments, Brantel soils in interdune areas, areas of playa that are devoid of vegetation, and some actively moving sand dunes. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Aquic Torriorthents are very deep and somewhat poorly drained. They formed in alluvium derived dominantly from rhyolitic volcanic ash and mixed

rock sources. The surface layers are loam, sand, sandy loam, or loamy sand. A thin, white salt crust is on the surface in summer and fall. The lower layer to a depth of 60 inches or more is stratified silt loam, sandy loam, coarse sand, and gravelly sand. The soil contains 0 to 15 percent rock fragments consisting of fine and medium pumice gravel.

The Aquents are very deep and are poorly or very poorly drained. They formed in alluvium derived dominantly from rhyolitic volcanic ash and mixed rock sources. The surface layers are sandy loam, loam, or loamy sand. A thin, white salt crust is on the surface in summer and fall. The next layer to a depth of 60 inches or more is coarse sand or loamy sand. Layers of sandy loam, silt loam, or silty clay loam are in the next layer in some areas. The soil contains 0 to 5 percent fine and medium pumice gravel.

The Deepwell soil is very deep and somewhat excessively drained. It formed in aeolian deposits derived dominantly from rhyolitic volcanic ash. Typically, the soil is light gray sand or fine sand to a depth of 60 inches or more. Depth to the stratified basin sediments is 60 inches or more.

Properties:
Permeability of the Aquic Torriorthents is moderately slow to rapid (0.2-20in/hr) above the water table. A seasonal high water table comes up to a depth of 3 to 5 feet in the spring and summer. Around Mono Lake the water table is fed by freshwater springs which surface at the edge of the lake. Available water capacity is low to high (4-8 in.). Effective rooting depth is 36 to 60 inches. The soil is calcareous in the surface layer. The soil reaction in the surface layer is moderately to very strongly alkaline (pH 7.8-10.0); in the lower layers, it is neutral to strongly alkaline (pH 7.0-9.0). For the surface layer, the electrical conductivity of the saturation extract is 2.0 to 20 mmhos/cm and the exchangeable sodium percentage is 5 to 20 percent. The lower layer is typically nonsaline-nonsodic. Salinity and alkalinity of the surface layer increase during fall as salts accumulate on the soil surface. The organic carbon content is less than 0.6 percent. Runoff is very slow or ponded. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low when the soil surface is moist and moderate when dry and bare.

Permeability of the Aquents is moderately slow to rapid (0.2-20 in/hr) above the water table. A seasonal high water table is at a depth of 0 to 36 inches in the spring and summer. The whole profile is saturated for at least a few days in the spring. Around Mono Lake the water table is fed by freshwater springs which surface at the edge of the lake. Available water capacity is low to high (4 to 8 in.). Effective rooting depth is at least 60 inches for water-tolerant plants but is limited to depths between 5 and 30 inches for plants that are not water-tolerant. The soil is calcareous in the surface layer. The soil reaction in the surface layer is moderately to very strongly alkaline (pH 7.8-10.0); in the lower layers, it is neutral to moderately alkaline (pH 7.0- 8.4). For the surface layer, the electrical conductivity of the saturation extract is 2 to 20 mmhos/cm and the percentage of exchangeable sodium is 15 to 50 percent. The lower layer is typically nonsaline-nonsodic. Salinity and alkalinity of the surface layer increase during fall as salts accumulate on the soil surface. The organic carbon content is less than 0.6 percent. Runoff is very slow or ponded. The water erosion condition class is

estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low when the soil surface is moist and moderate when dry and bare. During windy weather this unit receives saline dust from nearby playa areas.

Permeability of the Deepwell soil is rapid (6-20 in/hr). Available water capacity is low (3-5 in). The effective rooting depth is 60 inches or more. The soil is noncalcareous. The soil reaction is neutral to mildly alkaline (pH 6.6-7.8). The organic carbon content is less than 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the Deepwell soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is high under native conditions and very high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on the Aquic Torriorthents is mainly:

inland saltgrass (*Distichlis stricta*)	40%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	15%
black greasewood (*Sarcobatus vermiculatus*)	10%
annual forbs	10%
basin wildrye (*Elymus cinereus*)	5%

The annual production of air-dry vegetation ranges from 600 to 1,000 pounds per acre. Vegetation covers 5 to 20 percent of the soil surface.
Range site name: Alkali wet meadow 8-12" p.z. (CA-26-32)

The potential plant community on the Aquents is mainly:

inland saltgrass (*Distichlis stricta*)	25%
alkali sacaton (*Sporobolus airoides*)	20%
Nevada bluegrass (*Poa nevadensis*)	20%
sedges (*Carex sp.*)	5%

The annual production of air-dry vegetation ranges from 800 to 1,600 pounds per acre. Vegetation covers 20 to 80 percent of the soil surface.
Range site name: Alkali wet meadow 8-12" p.z. (CA-26-32)

The potential plant community on the Deepwell soil is mainly:

big sagebrush (*Artemisia tridentata*)	15%
hairy horsebrush (*Tetradymia comosa*)	15%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%
black greasewood (*Sarcobatus vermiculatus*)	10%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	8%
spiny hopsage (*Grayia spinosa*)	5%
fourwing saltbush (*Atriplex canescens*)	5%
desert needlegrass (*Stipa speciosa*)	5%
inland saltgrass (*Distichlis stricta*)	2%
annual forbs	2%

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface.
Range site name: Alkali ashy sand 10-12" p.z. (CA-26-33)

This unit is poorly suited for rangeland seeding due to the saline-sodic surface layer in most areas. This unit has a moderate to severe limitation for fencing due to potential wetness, ponding, excess salts, and the loose, sandy textures of the Deepwell soil.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the high water table and saline-sodic surface layer. The Aquents and Aquic Torriorthents have high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the high water table and saline-sodic surface layer. Drainage is needed if improved roads and building foundations are constructed. Sulfate-resistant concrete should be used in any construction project. Slow substrata permeability and the high water table increases the possibility of failure of septic tank absorption fields. The Deepwell soil has a very limited ability to support a load for foundations or vehicle traffic. Dirt roads on the Deepwell soil usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the high water table and uneven topography.

104 - Arizo very bouldery loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, thermic Typic Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans in Owens Valley. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans, which are joined together to form long bajadas, are incised with some shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouth of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,700 to 4,500 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 57 to 59°F, and the mean 32° frost-free season is 200 to 230 days. Mean annual snowfall is about 2 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the surface is covered with about 20 percent boulders and stones, 10 percent cobbles, and 20 percent gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is pale brown very bouldery loamy coarse sand about 10 inches thick. Some areas have a thin, fragile layer with vesicular pores and loamy textures about 3 inches below the soil surface. The next layer to a depth of 60 inches or more is pale brown very stony and extremely stony loamy coarse sand. It contains about 60 percent rock fragments consisting of about 20 percent boulders and stones, 20 percent cobbles, and 10 percent gravel.

Inclusions:
Included in this unit are small areas of Arizo soils with bouldery or extremely bouldery surface layers, Yellowrock soils, Pajuela and Thibau soils at the higher elevations, Bitter soils, Garlock Variant soils, Yermo soils, moist soils along stream drainages, rubbleland, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Arizo soil is rapid (6-20 in/hr). Available water capacity is very low (1.0-2.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous on the east side of Owens Valley and near the Alabama Hills. The soil reaction is mildly to moderately alkaline (pH 7.4-8.0). The electrical conductivity of the saturation extract is 0.3 to 1.0 mmhos/cm, and the exchangeable sodium percentage is 0 to 10 percent. The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

white bursage (Franseria dumosa)	30%
creosotebush (Larrea divaricata)	20%
desert needlegrass (Stipa speciosa)	10%
allscale saltbush (Atriplex polycarpa)	10%
shadscale (Atriplex confertifolia)	10%
galleta grass (Hilaria jamesii)	5%
annual forbs	5%
white burrobush (Hymenoclea salsola)	T

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers about 15 percent of the soil surface. The suitability of this unit for rangeland seeding is very poor due to the low precipitation, many large rock fragments, and sandy textures. This unit has a severe limitation for fencing due to the many large stones.
Range site name: Arid loam 4-6" p.z. (CA-29-45)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles.

Plate 3. Typical landscape of unit 104 near Cartago in southern Owens Valley. Unit 135 is on the lower mountain slopes in background. Looking west toward the Sierra Nevada.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many large rock fragments. Excavations are impeded by the many large rock fragments. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control suface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

105 - Arizo - Yellowrock complex, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, thermic Typic Torriorthents (Arizo)
Sandy, mixed, thermic Typic Torriorthents (Yellowrock)

Setting:
This mapping unit is on bouldery and stony alluvial fans on the east side of Owens Valley and on the west side near Olancha. Most of these fans are

joined together to form long bajadas and are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly desert shrubs, perennial grasses. and annual forbs. Elevation is 3,700 to 4,500 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 57 to 59°F, and the mean 32°frost-free season is 200 to 230 days. Mean annual snowfall is about 2 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Arizo soil and 25 percent Yellowrock soil. The Arizo soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map then separately at the scale used.

Inclusions:
Included in this unit are small areas of very bouldery Arizo soils, soils similar to the Arizo or Yellowrock soils that have coarse sandy loam textures, Pajuela and Thibau soils at the higher elevations, Bitter soils, Garlock Variant soils, moist soils along stream drainageways, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Arizo soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 4 percent boulders and stones, 5 percent cobbles, and 20 percent gravel. The surface layer is pale brown bouldery loamy coarse sand about 10 inches thick. The next layer is pale brown very stony loamy coarse sand to a depth of 60 inches or more. This layer contains about 40 percent rock fragments consisting of about 15 percent boulders and stones, 15 percent cobbles, and 10 percent gravel. Some areas have a thin, fragile layer with vesicular pores and bouldery sandy loam textures about 3 inches below the soil surface. In some areas the surface layer is stony loamy coarse sand.

The Yellowrock soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 1 percent boulders and stones, 5 percent cobbles, and 20 percent gravel. The surface layer is pale brown gravelly loamy coarse sand about 10 inches thick. The next layer is pale brown gravelly and cobbly loamy coarse sand to a depth of 60 inches or more. This layer contains about 25 percent rock fragments consisting of about 1 percent stones, 10 percent cobbles, and 15 percent gravel. Some very gravelly lenses are in this layer above a depth of 40 inches. In some areas the surface layer is loamy coarse sand.

Properties:
Permeability of the Arizo soil is rapid (6.0-20 in/hr). Available water capacity is very low (1.2-2.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous on the east side of Owens Valley and near the Alabama Hills. It is mildly to moderately alkaline (pH 7.4-8.4). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The

water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is contrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Yellowrock soil is rapid (6.0-20 in/hr). Available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous on the east side of Owens Valley and near the Alablma Hills. It is mildly to moderately alkaline (pH 7.4-8.4). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

white bursage (*Franseria dumosa*)	30%
creosotebush (*Larrea divaricata*)	20%
desert needlegrass (*Stipa speciosa*)	10%
shadscale (*Atriplex confertifolia*)	10%
allscale saltbush (*Atriplex polycarpa*)	10%
annual forbs	10%
galleta grass (*Hilaria jamesii*)	5%
white burrobush (*Hymenoclea salsola*)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers about 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation, many large rock fragments, and sandy textures. This unit has a moderate to severe limitation for fencing due to the many large rock fragments of the Arizo soil and sandy textures.
Range site name: Arid loam 4-6" p.z. (CA-29-45)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the many large rock fragments in the Arizo soil. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the many large rock fragments in the Arizo soil. Some cutbanks in the Yellowrock soil are not stable and are subject to slumping. Significant rilling by water may occur on dirt roads that run up and down the slope. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(30), nonirrigated. This unit is very poorly suited for irrigated crops due to the many large rock fragments and sandy textures.

Plate 4. Unit 105 near Cartago in southern Owens Valley. Note the lack of boulders and stones in some spots. Looking northeast across Owens Lake (dry) toward the Inyo Mountains.

106 - Badland

Taxonomic Class:
none

Setting:
This mapping unit is on severely eroded areas on alluvial fan terraces. Slopes are 50 to 75 percent. The badlands formed in silty and loamy lakebed sediments derived dominantly from mixed rock sources. Areas are irregular in shape and 10 to 40 acres in size. The native vegetation is mainly sparse, alkali-tolerant desert shrubs and forbs. Elevation is 4,400 to 4,800 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 60°F, and the mean 32° frost-free season is about 200 days. Mean annual snowfall is about 5 inches.

Typical Profile:
Typically, the material is highly stratified silt loam and silty clay loam to a depth of 60 inches or more. In some areas, a few of the strata have been hardened into rock.

Inclusions:
Included in this unit are small areas of Typic Durorthids and Entic Durorthids (soils with hardpans) on gravelly ridgetops, Yermo soils in drainageways, and areas that have slopes of less than 50 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability is estimated as slow to very slow (0.06-0.2 in/hr). These sediments are strongly sodic. Runoff is very rapid. The water erosion condition class is estimated as moderate under both native and bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions, although the soil is very dusty if it is disturbed when dry.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (*Atriplex confertifolia*)	40%
allscale saltbush (*Atriplex polycarpa*)	30%
desert trumpet (*Eriogonum inflatum*)	10%
red brome (*Bromus rubens*)	5%
inland saltgrass (*Distichlis stricta*)	5%
annual forbs	5%

The annual production of air-dry vegetation is about 50 pounds per acre. Vegetation covers less than 5 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the steep slopes and strongly sodic condition of the sediments. This unit has a severe limitation for fencing due to the steep slopes.
Range site name: Upland arid loam 4-6" p.z. (CA-29-44)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the very steep slopes, high erosion hazard, and dustiness.

Engineering Limitations:
If this unit is used for building sites, the main limitations are very steep slopes, high erosion hazard, and excess sodium. Dirt roads through this unit are highly susceptible to rill and gully erosion.

Interpretive Groups:
This mapping unit is in capability class VIII. This unit is very poorly suited for irrigated agriculture due to the excess sodium and steep slopes.

107 - Washoe very bouldery loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, mesic Xerollic Haplargids

Setting:
This very deep, well drained soil is on alluvial fans and fan terraces on the west side of Owens Valley. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans and fan terraces are joined together to form long bajadas and are incised with shallow washes and a few steep-sided drainageways. Stringers of stones and boulders radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation ranges from 5,100 to 6,500 feet. The mean annual precipitation ranges from 8 to 12 inches, the mean annual air temperature is 48 to 53°F, and the mean 32°frost-free season is 130 to 150 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 30 to 60 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 50 percent rock fragments consisting of about 20 percent boulders and stones, 10 percent cobbles, and 20 percent fine gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is brown and grayish brown very bouldery loamy coarse sand about 20 inches thick. The subsoil is yellowish brown and brown, very stony sandy loam or sandy clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is very pale brown very stony loamy coarse sand. The subsoil and substratum contain about 50 percent rock fragments consisting of about 25 percent boulders and stones, 10 percent cobbles, and 15 percent gravel.

Inclusions:
Included in this unit are small areas of Washoe soils with bouldery or extremely bouldery surface layers, Washoe Variant soils, soils similar to the Washoe soil but with more organic carbon (Aridic Argixerolls), Tuttle soils, Rovana soils, stringers of rubbleland radiating from canyon mouths, moist soils along stream drainageways, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Washoe soil is moderately rapid to moderately slow (0.2-6.0 in/hr). Available water capacity is low (2.5-4.0 in). The effective rooting depth is 60 inches or more. The soil is noncalcareous. The soil reaction is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and recreation.

Vegetation and Rangeland:
The potential plant community is mainly :

desert bitterbrush (*Purshia glandulosa*)	25%
big sagebrush (*Artemisia tridentata*)	20%
desert needlegrass (*Stipa speciosa*)	20%
blackbrush (*Coleogyne ramosissima*)	5%
Nevada ephedra (*Ephedra nevadensis*)	5%
perennial forbs	5%
Indian ricegrass (*Oryzopsis hymenoides*)	3%
Nevada bluegrass (*Poa nevadensis*)	3%
antelope bitterbrush (*Purshia tridentata*)	3%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
green Mormon tea (*Ephedra viridis*)	2%
annual forbs	2%

The annual production of air-dry vegetation ranges from 500 to 700 pounds per acre. Vegetation covers about 30 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the many large rock fragments. This unit has a severe limitation for fencing due to the many large rock fragments.
Range site name: Stony granitic fan 8-10"p.z. (CA-29-33)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and slow subsoil permeability in some areas. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many large rock fragments and slow subsoil permeability in some areas. Excavations are impeded by the many large rock fragments. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control runoff. If the Washoe soil is used for septic tank absorption fields, absorption lines should be placed below the slowly permeable layer (below 48 inches).

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments.

108 - Washoe* - Washoe Variant complex, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, mesic Xerollic Haplargids (Washoe)
Fine-loamy, mixed, mesic Xerollic Haplargids (Washoe Variant)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces on the west side of Owens Valley. Most of these fans are joined together to form a long bajada and are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses and annual forbs. Elevation is 5,100 to 6,400 feet. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is 48 to 53°F, and the mean 32° frost-free season is 130 to 150 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 30 to 60 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Washoe soil and 25 percent Washoe Variant soil. The Washoe soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the Washoe Variant soil but with sandy loam subsoils (coarse-loamy, mixed, mesic Xerollic Haplargids), very bouldery Washoe soils, Tuttle soils, Rovana soils, soils with more organic carbon than the Washoe and Washoe Variant soils (Aridic Argixerolls), moist soils in stream drainageways, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Washoe soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 30 percent rock fragments consisting of about 3 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The surface layer is grayish brown and brown bouldery loamy coarse sand about 20 inches thick. The surface 7 inches has loose consistency. The boulders and stones project 3 to 24 inches above the soil surface. The subsoil is yellowish brown and brown, very stony sandy loam or sandy clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is very pale brown very stony loamy coarse sand. The subsoil and substratum contain about 50 percent rock fragments consisting of about 25 percent boulders and stones, 10 percent cobbles, and 15 percent gravel.

The Washoe Variant soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the soil is covered with about 25 percent rock fragments consisting of about 1 percent boulders and stones, 2 percent cobbles, and 20 percent fine gravel. The surface layer is brown gravelly loamy coarse sand about 7 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is brown gravelly sandy loam about 5 inches thick. The subsoil is yellowish brown gravelly and cobbly sandy clay loam about 23 inches thick. The substratum to a depth of 60 inches or more is strong brown very cobbly and very stony sandy loam. The subsoil and substratum contain an average of about 30 percent rock fragments consisting

mainly of cobbles and stones. In these layers, the rock fragment content tends to increase with depth.

Properties:
Permeability of the Washoe soil is moderately rapid to moderately slow (0.2-6.0 in/hr). The available water capacity is low (3.0-4.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Washoe Variant soil is moderately slow (0.2-0.6 in/hr). The available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert bitterbrush (*Purshia glandulosa*)	25%
big sagebrush (*Artemisia tridentata*)	20%
desert needlegrass (*Stipa speciosa*)	20%
blackbrush (*Coleogyne ramosissima*)	5%
Nevada ephedra (*Ephedra nevadensis*)	5%
perennial forbs	5%
Indian ricegrass (*Oryzopsis hymenoides*)	3%
Nevada bluegrass (*Poa nevadensis*)	3%
antelope bitterbrush (*Purshia tridentata*)	3%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
green Mormon tea (*Ephedra viridis*)	2%
annual forbs	2%

The annual production of air-dry vegetation ranges from 600 to 800 pounds per acre. Vegetation covers about 30 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas.

This unit is very poorly suited to rangeland seeding due to the many large rock fragments. This unit has a moderate to severe limitation for fencing due to the many large rock fragments of the Washoe soil and sandy textures. Range site name: Stony granitic fan 8-10"p.z. (CA-29-33)

Plate 5. Typical landscape of unit 108 on the upper alluvial fan terraces in Owens Valley. Unit 109 occurs on the Sierra Nevada escarpment (left background). Looking north up the west side of Owens Valley.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments, sandy surface layers, and slow subsoil permeability in some areas. This unit has low to moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many large rock fragments and slow subsoil permeability in some areas. Significant rilling by water may occur on dirt roads that run up and down the slope. Roads shoud be designed to control surface runoff. If these soils are used for septic tank absorption fields, absorption lines should be placed below the slowly permeable layer (below 48 inches).

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments.

* The Washoe soil mapped in this unit is a taxadjunct to the Washoe series because it has a warmer mean annual soil temperature, a thinner solum, a lower clay content in the subsoil, a longer frost-free season, and a higher elevation range. These differences, however, do not greatly affect use and management.

109 - Berent - Glenbrook families association, 30 to 50 percent slopes

Taxonomic Class:
Mixed, mesic Xeric Torripsamments (Berent family)
Mixed, mesic, shallow Xeric Torripsamments (Glenbrook family)

Setting:
This mapping unit is on steep mountain slopes at the base of the Sierra Nevada and White Mountains. Slopes are steep and are slightly vertically concave. The native vegetation is mainly cool desert shrubs, pinyon pines, perennial grasses, and annual forbs. Elevation is 5,600 to 8,000 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature is 42 to 52°F, and the mean 32° frost-free season is 110 to 150 days. A one foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 50 to 80 inches.

Percentages:
This unit is 50 percent Berent family soils and 30 percent Glenbrook family soils. The Berent family soils are on smooth, concave slopes with shrub vegetation, and the Glenbrook family soils are associated with rock outcrops and scattered pinyon pine vegetation.

Inclusions:
Included with this unit are small areas of soils similar to the Glenbrook family soils but with sandy loam textures, rock outcrops and very bouldery shallow soils associated with the Glenbrook family soils, soils with sandy loam subsoils, soils formed on metamorphic rock, and soils with slopes of less than 30 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Berent family soils are very deep and somewhat excessively drained. They formed in slope wash and material weathered in place from granitic rock. The soil surface is covered with about 25 percent fine and medium gravel. The surface layer is grayish brown gravelly loamy coarse sand. The surface 2 or 3 inches has loose consistency. The next layer is gravelly and cobbly loamy coarse sand. Decomposing granitic bedrock is at a depth of 20 to more than 60 inches. The surface layer contains about 25 percent gravel, and the lower layer contains about 15 percent gravel and 10 percent cobbles. In some areas the surface layer is loamy coarse sand.

The Glenbrook family soils are shallow and somewhat excessively drained. They formed in material weathered in place from granitic rock. The soil surface is covered with about 30 percent rock fragments consisting of 0 to 10 percent boulders and stones, 0 to 5 percent cobbles, and 15 to 25 percent gravel. The surface layer is grayish brown bouldery, stony, or gravelly loamy coarse sand. The surface 2 or 3 inches has loose consistency. Decomposing granitic bedrock is at a depth of 10 to 20 inches.

Properties:
Permeability of the Berent family soils is rapid (6-20 in/hr). The available water capacity is low (3.5-4.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral (pH 6.6-7.3). The organic carbon content is 0.3 to 0.6 percent. Runoff is very slow. The water

erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Glenbrook family soils is rapid (6-20 in/hr). The available water capacity is very low (0.6-1.5 in). Effective rooting depth is 10 to 20 inches. Some of the larger shrub and tree roots may enter cracks in the decomposing bedrock. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.6-7.5). The organic carbon content is 0.3 to 0.6 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	25%
desert bitterbrush (*Purshia glandulosa*)	20%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	15%
desert needlegrass (*Stipa speciosa*)	15%
Indian ricegrass (*Oryzopsis hymenoides*)	10%
Dorr's sage (*Salvia dorrii*)	5%
singleleaf pinyon (*Pinus monophylla*)	T

The annual production of air-dry vegetation ranges from 600 to 800 pounds per acre. Vegetation covers 25 to 30 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the steep slopes. It is very poorly suited to the production of pinyon pine firewood. This unit has a moderate limitation for fencing due to the sandy textures, slopes, and shallow bedrock of the Glenbrook family soils.
Range site name: Steep sandy slope 8-10"p.z. (CA-29-34)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the steep slopes and sandy textures. This unit is a poor source of pinyon nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the steep slopes and sandy textures. Excavations for roads and buildings increases the hazard of erosion. Cutbanks are not stable and subject to slumping and rill erosion. Access roads greatly increase the hazard of erosion, particularly at points where runoff water exits onto the downslope soil. Any soil loss on the shallow soils can significantly reduce their long term productivity.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the steep slopes, sandy textures, and some shallow soils.

110 - Bitter - Garlock Variant complex, 2 to 9 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, thermic Typic Haplargids (Bitter)
Fine-loamy, mixed, thermic Typic Haplargids (Garlock Variant)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces on the west side of Owens Valley near Owens Lake. Most of these fans and fan terraces are joined together to form a long bajada and are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,700 to 4,700 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 55 to 59°F, and the mean 32° frost-free season is 200 to 230 days. Mean annual snowfall is about 2 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Bitter soil and 25 percent Garlock soil. The Bitter soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the Garlock Variant soil but with sandy loam subsoils (coarse-loamy, mixed, thermic Typic Haplargids), very bouldery Bitter soils, Arizo soils, Yellowrock and Cajon soils in drainageways, and soils with slopes of less than 2 or more than 9 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Bitter soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 20 percent rock fragments consisting of about 5 percent boulders and stones, 1 percent cobbles, and 15 percent fine gravel. The surface layer is pale brown bouldery loamy sand about 6 inches thick. The next layer is a bouldery loam vesicular layer about 2 inches thick. The subsoil is brownish yellow very gravelly and very cobbly sandy loam or sandy clay loam about 22 inches thick. The substratum to a depth of 60 inches or more is very cobbly sandy loam. The subsoil and substratum contain about 45 percent rock fragments consisting of about 5 percent boulders and stones, 25 percent cobbles, and 25 percent gravel. Some areas have a thin, fragile layer with vesicular pores and loamy textures about 3 inches below the soil surface. In some areas the surface layer is stony loamy sand.

The Garlock Variant soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the surface is covered with about 20 percent rock fragments consisting of about 2 percent boulders and stones, 1 percent cobbles, and 15 percent gravel. The surface layer is light yellowish brown gravelly loamy coarse sand about 2 inches thick. The next layer is brownish yellow gravelly sandy loam about 4 inches thick. The subsoil is reddish yellow gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 60 inches or more is reddish yellow stony sandy loam. The subsoil and substratum contain about 25 percent rock fragments consisting of about 5 percent boulders and stones, 5 percents cobbles, and 15 percent gravel. Some areas have a thin, fragile layer with vesicular pores and loamy textures about 3 inches below the soil surface. In some areas the surface layer is gravelly sandy loam.

Properties:
Permeability of the Bitter soil is moderately rapid to moderately slow (0.2-6.0 in/hr). The available water capacity is low (2.5-3.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous in most areas and is moderately alkaline (pH 7.9-8.4). The organic carbon content is 0.2 to 0.3 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Garlock Variant soil is moderately slow (0.2-0.6 in/hr). Available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous in most areas and is moderately alkaline (pH 7.9-8.4). The organic carbon content is 0.2 to 0.3 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

creosotebush (*Larrea divaricata*)	20%
white bursage (*Franseria dumosa*)	10%
allscale saltbush (*Atriplex polycarpa*)	10%
desert needlegrass (*Stipa speciosa*)	10%
shadscale (*Atriplex confertifolia*)	5%
Nevada ephedra (*Ephedra nevadensis*)	5%
spiny hopsage (*Grayia spinosa*)	5%
annual forbs	5%
California buckwheat (*Eriogonum fasciculatum*)	5%
common winterfat (*Eurotia lanata*)	3%
galleta grass (*Hilaria jamesii*)	2%
desert trumpet (*Eriogonum inflatum*)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and many large rock fragments. This unit has a moderate limitation for fencing due to the many large rock fragments of the Bitter soil.
Range site name: Arid loam 4-6"p.z. (CA-29-45)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments, sandy surface layers, and slow subsoil permeability in some areas. This unit has low to moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are many large rock fragments and slow subsoil permeability in some areas. Significant rilling by water may occur on dirt roads that run up and down the slope. Roads should be designed to control surface runoff. If this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and by placing the lines below a depth of 48 inches.

Interpretive Groups:
This mapping unit is in capability subclass VIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments.

111 - Brantel gravelly coarse sand, 2 to 9 percent slopes

Taxonomic Class:
Ashy, mesic Xeric Torripsamments

Setting:
This very deep, excessively drained, sandy soil is on valley floors and old lake terraces in the Mono Lake area. It formed in rhyolitic volcanic ash derived from airfall, eolian, and alluvial ash deposits. Slopes are undulating to gently rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,300 to 7,300 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature is 44 to 47°F, and the mean 32° frost-free season is about 125 days. A 2 to 3-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 50 to 75 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the soil surface is covered with about 20 percent fine and medium pumice and obsidian gravel. The surface layer is light gray gravelly coarse sand about 2 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light gray coarse sand and gravelly coarse sand to a depth of 60 inches or more. The soil contains an average of about 15 percent pumice and obsidian gravel. In some areas the surface layer is loamy sand.

Inclusions:
Included with this unit are small areas of soils similar to the Brantel soil but with thin strata of loamy or very gravelly material in the lower layer (Xeric Torriorthents), Cowtrack Variant soils at the higher elevations, Brantel Variant soils near the Mono Craters, Brantel gravelly loamy sand, soils underlain by a hard silt layer at depths of 25 to 60 inches in southeastern Mono Basin, and soils with slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Brantel soil is very rapid (more than 20 in/hr). Available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous. It is slighty acid to mildly alkaline (pH 6.1-7.8), and alkalinity increases with depth. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions. During windy weather this unit may receive saline dust from nearby playa areas around Mono Lake.

Plate 6. Typical landscape of unit 111 in southern Mono Basin. Note the large antelope bitterbrush (dark shrub). Looking northeast towards Mono Lake and the Bodie Hills.

Use:
At present, this unit is used for grazing, wildlife habitat, and recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

basin big sagebrush (*Artemisia tridentata tridentata*)	30%
antelope bitterbrush (*Purshia tridentata*)	30%
Indian ricegrass (*Oryzopsis hymenoides*)	20%
needle and thread grass (*Stipa comata*)	10%
annual forbs	5%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	2%
common pricklygilia (*Leptodactylon pungens*)	2%
hairy horsebrush (*Tetradymia comosa*)	1%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	T
little horsebrush (*Tetradymia glabrata*)	T

The annual production of air-dry vegetation ranges from 600 to 1000 pounds per acre. Vegetation covers 25 to 30 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to sandy, droughty textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Deep ashy sand 10-12" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the loose, sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the very sandy texture and very rapid permeability. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the building site before construction is begun. Cutbanks are not stable and are subject to slumping. Dirt roads on this unit usually do not have a water erosion hazard due to the very rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the very sandy textures and the hazard of soil blowing.

112 - Brantel gravelly loamy sand, 0 to 5 percent slopes

Taxonomic Class:
Ashy, mesic Xeric Torripsamments

Setting:
This very deep, somewhat excessively drained soil occurs on alluvial fans and valley floors. It formed in rhyolitic volcanic ash derived from airfall and alluvial ash deposits. The native vegetation is cool desert shrubs,

perennial grasses, and annual forbs. Elevation is 5,300 to 7,300 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 44 to 53°F, and the mean 32° frost-free season is 125 to 150 days. A one foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 65 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the surface layer is light gray gravelly loamy sand about ½-inch thick. The next layer is light gray loamy sand about 32 inches thick. The upper 2 or 3 inches of soil has loose consistency. The next layer to a depth of 60 inches or more is light gray loamy sand and gravelly sand. The soil contains about 10 percent pumice gravel overall. In some areas, the surface layer is loamy sand.

Inclusions:
Included in this unit are small areas of soils similar to the Brantel soils that have thin strata of loamy or very gravelly material in the lower layer (Xeric Torriorthents), soils in drainageways that have dark surface layers and large big sagebrush vegetation (Aridic Haploxerolls), Sawavu soils, Rovana soils in areas of mixed mineralogy, Hammil soils at the lower elevations, slightly saline-sodic Brantel soils near valley floors, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Brantel soil is rapid (6-20 in/hr). Available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to mildly alkaline (pH 6.5-7.5). The organic carbon content is 0.2 to 0.35 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions. In windy weather, areas in Mono Basin may receive saline dust from playa areas around Mono Lake.

Use:
At present, this unit is used for grazing, wildlife habitat, and recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	40%
Indian ricegrass (*Oryzopsis hymenoides*)	30%
needle and thread grass (*Stipa comata*)	10%
western needlegrass (*Stipa occidentalis*)	10%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
Nevada ephedra (*Ephedra nevadensis*)	2%
basin big sagebrush (*Artemisia tridentata tridentata*)	2%
annual forbs	2%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	T
staghorn cholla (*Opuntia echinocarpa*)	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is poorly suited for rangeland seeding due to the low precipitation and droughty surface layer. This unit has severe limitation for fencing due to the loose, sandy textures.
Range site name: Sandy 8-10" p.z. (NV-26-20)

Recreational Development:
If this unit is used for recreational use the main limitation is the loose, sandy surface layer. The soil has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Plate 7. Typical landscape of unit 112 in Adobe Valley. Looking northwest towards the Cowtrack Mountain area.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy texture of the soil. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the building site before construction is begun. Cutbanks are not stable and are subject to slumping. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability unit IVs-4(26), irrigated, and IVe-1(26),

nonirrigated. This unit is moderately well suited for irrigated agriculture. It is limited mainly by rapid permeability, low available water capacity, short growing season, and the hazard of soil blowing.

113 - Brantel Variant - Brantel complex, 2 to 15 percent slopes

Taxonomic Class:
Cindery, mesic Xeric Torriorthents (Brantel Variant)
Ashy, mesic Xeric Torripsamments (Brantel)

Setting:
This mapping unit is on volcanic cinder and ash deposits near the Mono Craters. The topography is undulating to rolling. The native vegetation is cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,500 to 7,000 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A 2 to 3-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is about 65 inches. Some thundershowers occur in summer, but they are infrequent and limited extent.

Percentages:
This unit is 60 percent Brantel Variant soil and 25 percent Brantel soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Brantel Variant soils that are very cobbly, soils similar to the Brantel soil but with thin layers of very gravelly material in the lower layer (Xeric Torriorthents), Tuttle Variant soils in some of the drainageways and on alluvial terraces, soils with slopes of less than 2 or more than 15 percent, and rock outcrops near Panum Crater. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Brantel Variant soil is very deep and excessively drained. It formed in airfall deposits of rhyolitic volcanic ash and cinders. Typically, the soil surface is covered with about 2 percent cobbles and 30 percent gravel(pumice and obsidian fragments). The surface layer is light brownish gray gravelly sand about 5 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light gray loamy sand about 4 inches thick. The next layer to a depth of 60 inches or more is light gray extremely gravelly coarse sand. This layer contains about 60 percent rock fragments consisting of about 1 percent stones, 5 percent cobbles, and 55 percent gravel (pumice and obsidian fragments). In some areas the surface layer is coarse sand.

The Brantel soil is very deep and excessively drained. It formed in airfall and eolian deposits of rhyolitic volcanic ash. Typically, the soil surface is covered with about 20 percent fine and medium gravel (pumice and obsidian). The surface layer is light gray gravelly coarse sand about 2 inches thick. The next layer is light gray coarse sand and gravelly coarse sand to a depth of 60 inches or more. Layers of loamy sand occur in this layer in some areas. The surface 2 or 3 inches has loose consistency. The

soil contains an average of about 15 percent gravel (pumice and obsidian fragments).

Properties:
Permeability of the Brantel Variant soil is rapid to very rapid (6 to more than 20 in/hr). The available water capacity is very low (1.0-2.0 in). Effective rooting depth is 60 inches or more, although most roots are concentrated in the surface layer. The soil is noncalcareous and is slightly acid to neutral (pH 6.1-7.0). Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Brantel soil is very rapid (more than 20 in/hr). Available water capacity is low to moderate (4.5-5.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.6-7.8). The organic carbon content is 0.2 to 0.35 percent. Runoff is very slow. The water erosion condition is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated is a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for wildlife habitat and grazing.

Vegetation and Rangeland:
The potential plant community on the Brantel Variant soil is mainly:

desert peach (Prunus andersonii)	25%
Wyoming big sagebrush (Artemisia tridentata wyomingensis)	20%
antelope bitterbrush (Purshia tridentata)	20%
Indian ricegrass (Oryzopsis hymenoides)	10%
basin big sagebrush (Artemisia tridentata tridentata)	5%
annual forbs	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	3%
rubber rabbitbrush (Chrysothamnus nauseosus)	3%
common pricklygilia (Leptodactylon pungens)	2%

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface.
Range site name: Gravelly sand 10-12" p.z. (CA-26-46)

The potential plant community on the Brantel soil is mainly:

basin big sagebrush (Artemisia tridentata tridentata)	30%
antelope bitterbrush (Purshia tridentata)	30%
Indian ricegrass (Oryzopsis hymenoides)	20%
needle and thread grass (Stipa comata)	10%
annual forbs	5%
rubber rabbitbrush (Chrysothamnus nauseosus)	2%
common pricklygilia (Leptodactylon pungens)	2%

hairy horsebrush (*Tetradymia comosa*)	1%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	T
little horsebrush (*Tetradymia glabrata*)	T

The annual production of air-dry vegetation ranges from 600 to 1000 pounds per acre. Vegetation covers 25 to 30 percent of the soil surface.
Range site name: Deep ashy sand 10-12" p.z. (CA-26-36)

This unit is very poorly suited to rangeland seeding due to the sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures and small stones of the Brantel Variant soil.

Plate 8. Typical landscape of unit 113 in southern Mono Basin. Looking southwest towards Panum Crater.

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the sandy textures. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy textures. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Dirt roads on this unit

usually do not have a water erosion hazard due to the very rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the rapid permeability, low available water capacity, short growing season, and the hazard of soil blowing.

114 - Buscones very gravelly loamy sand, 2 to 15 percent slopes

Taxonomic Class:
Ashy, mesic Xeric Torripsamments

Setting:
This moderately deep, somewhat excessively drained, sandy soil is on the upper volcanic tablelands and in the Benton Range. It formed in material weathered in place from soft, rhyolitic volcanic tuff. The topography is undulating to rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,200 to 7,200 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 45 to 50°F, and the mean 32° frost-free season is 125 to 150 days. A one foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the soil surface is covered with about 40 percent fine and medium pumice gravel. The surface layer is light gray very gravelly loamy sand about ½-inch thick. The next layer is light gray loamy sand about 18 inches thick. The next layer is white gravelly loamy sand about 13 inches thick over soft, white rhyolitic tuff. The soft tuff bedrock is at a depth of 31 inches in this typical profile, but can range from 20 to 40 inches deep. The surface 2 or 3 inches has loose consistency. The soil below the surface layer contains about 5 to 30 percent pumice gravel. In some areas the surface layer is gravelly loamy sand.

Inclusions:
Included in this unit are small areas of soils similar to the Buscones soil but with soft tuff at a depth of 40 to 60 inches, soils with a thin hardpan on top of the soft tuff, Sawavu soils, Wellington soils, soils underlain by hard metamorphic or granitic bedrock, soils that have very gravelly textures (Xeric Torriorthents), and soils with slopes of less than 2 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Buscones soil is rapid (6-20 in/hr). The available water capacity is low to very low (1.5-4.0 in). Effective rooting depth is 20 to 40 inches. The soil is noncalcareous and is neutral (pH 6.6-7.3). The organic carbon content is 0.1 to 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and

bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and some mining.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	40%
desert needlegrass (*Stipa speciosa*)	15%
desert bitterbrush (*Purshia glandulosa*)	10%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	10%
Nevada ephedra (*Ephedra nevadensis*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
perennial forbs	5%
annual forbs	3%
spiny hopsage (*Grayia spinosa*)	2%
bottlebrush squirreltail (*Sitanion hystrix*)	2%

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface. This unit is poorly suited for rangeland seeding due to the low precipitation and sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Sandy 8-10"p.z. (CA-26-20)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the loose, sandy surface layer and dustiness. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the soil depth. Cuts needed to provide essentially level building sites can expose the soft tuff. Buildings and roads should be designed to offset the limited ability of this soil to support a load. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the soil depth, low available water capacity, short growing season, and the hazard of soil blowing.

115 - Cajon gravelly loamy sand, 0 to 5 percent slopes

Taxonomic Class:
Mixed, thermic Typic Torripsamments

Setting:
This very deep, somewhat excessively drained sandy, soil is on alluvial fans and terraces in Owens Valley. It formed in alluvium derived dominantly from granitic rock sources. The topography is nearly level to gently sloping. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,600 to 4,800 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 56 to 60°F, and the mean 32° frost-free season is 190 to 225 days. Mean annual snowfall is about 2 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 20 percent fine granitic gravel. The surface layer is pale brown gravelly loamy sand about 35 inches thick. The next layer to a depth of 60 inches or more is light gray and very pale brown gravelly coarse sand. The soil contains about 20 percent fine and medium gravel. Strata of loamy coarse sand and gravelly loamy coarse sand are present in many areas. In some areas the surface layer is loamy coarse sand.

Inclusions:
Included in this unit are small areas of Seaman soils, Yellowrock soils, Arizo soils, Thibau soils at the higher elevations, Yermo soils, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Cajon soil is rapid (6-20 in/hr). The available water capacity is low (3.0-4.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous where it occurs on the east side of the Owens Valley. The soil reaction is mildly to moderately alkaline (pH 7.4-8.0). The electrical conductivity of the saturation extract is 0.3 to 1.0 mmhos/cm and the exchangeable sodium percentage is 4 to 12 percent below a depth of 1 foot. The soil contains 1 to 3 ppm of boron. The salt, boron, and exchangeable sodium content increases with depth, the surface foot of soil being relatively free of these. The organic carbon content is 0.1 to 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for wildlfe habitat and grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (*Atriplex confertifolia*)	15%
white bursage (*Franseria dumosa*)	10%

white burrobush (Hymenoclea salsola)		10%
allscale saltbush (Atriplex polycarpa)		5%
desert needlegrass (Stipa speciosa)		5%
Indian ricegrass (Oryzopsis hymenoides)		5%
bud sagebrush (Artemisia spinescens)		5%
Nevada ephedra (Ephedra nevadensis)		5%
common winterfat (Eurotia lanata)		5%
fourwing saltbush (Atriplex canescens)		5%
annual forbs		3%
spiny hopsage (Grayia spinosa)		2%

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the low precipitation and sandy textures. This unit has a moderate limitation for fencing due to the sandy textures.
Range site name: Arid loam 4-6"p.z. (CA-29-45)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the sandy texture. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy texture. The possibility of settlement can be minimized by compacting the building site before construction begins. Cutbanks are not stable and are subject to slumping.

Interpretive Groups:
This mapping unit is in capability class IVs-4(30), irrigated and subclass VIIe(30), nonirrigated. Some areas of this unit are moderately well suited for irrigated crops. They are limited by sandy textures and the hazard of soil blowing. The lesser suited areas are limited by uneven topography.

116 - Cashbaugh - Buscones* complex, 0 to 5 percent slopes

Taxonomic Class:
Mixed, mesic Lithic Torripsamments (Cashbaugh)
Mixed, mesic Xeric Torripsamments (Buscones*)

Setting:
This mapping unit is on lake terraces around Crowley Lake. The topography is nearly level to undulating. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,700 to 7,100 feet. The mean annual precipitation is 10 to 13 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A two-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is about 70 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Cashbaugh soil and 20 percent Buscones soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the Buscones soil but with bedrock at a depth of 40 to 60 inches, Brantel soils, rock outcrops of tuffaceous sandstone or conglomerate near the tops of some knolls, soils with sandy loam textures, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the surface area.

Typical Profile:
The Cashbaugh soil is shallow or very shallow and somewhat excessively drained. It formed in mixed alluvium and volcanic ash deposited over hard tuffaceous sandstone or conglomerate bedrock. Typically, the surface layer is grayish brown gravelly loamy sand about 1 inch thick. The next layer is brown loamy sand about 9 inches thick. Hard, tuffaceous sandstone bedrock is at a depth of 10 inches in this typical profile, but can range from 5 to 20 inches deep. The surface 2 or 3 inches has loose consistency. The soil averages 5 to 15 percent gravel and 0 to 3 percent angular cobbles (pumice and sandstone fragments).

The Buscones soil is moderately deep and somewhat excessively drained. It formed in mixed alluvium and volcanic ash deposited over hard tuffaceous sandstone or conglomerate bedrock. Typically, the surface layer is grayish brown gravelly loamy sand about 1 inch thick. The next layer is grayish brown loamy sand about 25 inches thick. Hard, tuffaceous sandstone and conglomerate bedrock is at a depth of 26 inches in this typical profile, but can range from 20 to 40 inches deep. The surface 2 or 3 inches has loose consistency. The soil contains 5 to 20 percent gravel and a few angular cobbles (pumice and sandstone fragments).

Properties:
Permeability of the Cashbaugh soil is rapid (6-20 in/hr). Available water capacity is very low (0.5-2.0 in). Effective rooting depth is 6 to 20 inches. Some roots enter cracks in the bedrock and can therefore tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.4 to 0.5 percent. The soil contains about 50 percent rhyolitic volcanic ash by weight. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and high under bare soil conditions.

Permeability of the Buscones soil is rapid (6-20 in/hr). The soil contains about 50 percent rhyolitic volcanic ash by weight. Available water capacity is low (2.5-4.0 in). Effective rooting depth is 20 to 40 inches. Some roots enter cracks in the bedrock and can therefore tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.4 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if

water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	25%
antelope bitterbrush (*Purshia tridentata*)	15%
Indian ricegrass (*Oryzopsis hymenoides*)	15%
needle and thread grass (*Stipa comata*)	15%
western needlegrass (*Stipa occidentalis*)	5%
perennial forbs	5%
sulfur buckwheat (*Eriogonum umbellatum polyanthum*)	5%
common pricklygilia (*Leptodactylon pungens*)	5%
basin wildrye (*Elymus cinereus*)	2%
Sandberg bluegrass (*Poa secunda*)	2%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
blue wildrye (*Elymus glaucus*)	1%
lupine (*Lupinus* sp.)	T

Plate 9. Typical landscape of unit 116 near Crowley Lake. Looking northeast across Long Valley towards Glass Mountain.

The annual production of air-dry vegetation ranges from 500 to 900 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface. This unit is poorly or very poorly suited to rangeland seeding due to the sandy textures, low precipitation, and many shallow soils. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the sandy textures and the shallow bedrock of the Cashbaugh soil.
Range site name: Shallow loamy sand 10-14"p.z. (CA-26-38) (Cashbaugh)
Ashy loamy sand 10-14"p.z. (CA-26-35) (Buscones)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and many shallow soils.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the shallow bedrock of the Cashbaugh soil and the sandy textures. Cuts needed to provide essentially level building sites can expose bedrock.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the many shallow soils, sandy textures, and short growing season.

* The Buscones soil mapped in this unit is a taxadjunct to the Buscones series because it has mixed mineralogy, is underlain by hard bedrock, and is in a higher precipitation zone. These differences, however, do not greatly affect use and management.

117 - Cashbaugh* - Brantel association, 0 to 5 percent slopes

Taxonomic Class:
Ashy, mesic Lithic Torripsamments (Cashbaugh*)
Ashy, mesic Xeric Torripsamments (Brantel)

Setting:
This mapping unit is on high elevation volcanic tablelands north of Bishop. The topography is nearly level to undulating with a few steep-sided, rocky drainageways. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,500 to 7,400 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 44 to 47°F, and the mean 32° frost-free season is 120 to 140 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 40 to 70 inches. Some thundershowers occur in the summer, but they are infrequent and of limited extent.

Percentages:
This unit is 50 percent Cashbaugh soil and 30 percent Brantel soil. The Cashbaugh soil is on the slightly higher tabletop positions and the Brantel soil in in slightly concave depressional areas.

Inclusions:
Included in this unit are small areas of soils similar to the Cashbaugh soil but with hard tuff bedrock at depths of 20 to 60 inches, shallow stony soils in drainageways, rock outcrops mainly along steep sideslopes of drainageways, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Plate 10. Unit 117 in the foreground. Although the soils appear to be very deep, many are actually shallow. Note that pinyon pines occur only on hills in background (shallow stony and bouldery soils of unit 138). Looking west toward the Granite Mountain area.

Typical Profile:
The Cashbaugh soil is shallow or very shallow and is somewhat excessively drained. It formed in rhyolitic volcanic ash deposited over hard volcanic tuff. Typically, the surface layer is light gray gravelly loamy sand about ½ inch thick. The next layer is light gray loamy sand about 16 inches thick. Hard, pink volcanic tuff is at a depth of 16 inches in this typical profile, but can range from 6 to 20 inches deep. The surface 2 or 3 inches has loose consistency. The soil contains 5 to 25 percent fine and medium gravel (pumice and obsidian fragments), with most of the gravel in the thin surface layer.

The Brantel soil is very deep and somewhat excessively drained. It formed in rhyolitic volcanic ash from airfall and alluvial ash deposits. The soil surface is covered with about 25 percent pumice pebbles. Typically, the surface layer is gravelly loamy sand about ½ inch thick. The next layer is light gray loamy sand to a depth of 60 inches or more. The surface 2 or 3 inches has loose consistency. The soil below the surface layer contains about 10 percent fine and medium gravel (pumice and obsidian fragments).

Properties:
Permeability of the Cashbaugh soil is rapid (6-20 in/hr). The available water capacity is very low (0.5-2.0 in). Effective rooting depth is 6 to 20 inches. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.0). The organic carbon content is 0.1 to 0.3 percent. The soil contains more than 60 percent rhyolitic volcanic ash by weight. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Brantel soil is rapid (6-20 in/hr). The available water capacity is moderate (5-7 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.0). The organic carbon content is 0.2 to 0.35 percent. The soil contains more than 60 percent rhyolitic volcanic ash by weight. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.
Vegetation and Rangeland:
The potential plant community on the Cashbaugh soil is mainly:

Wyoming big sagebrush (Artemisia tridentata wyomingensis)	35%
Indian ricegrass (Oryzopsis hymenoides)	35%
needle and thread grass (Stipa comata)	10%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	5%
spiny hopsage (Grayia spinosa)	5%
common pricklygilia (Leptodactylon pungens)	2%
low sage (Artemisia arbuscula)	T
perennial forbs	T
annual forbs	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface.

The potential plant community on the Brantel soil is mainly:

Wyoming big sagebrush (Artemisia tridentata wyomingensis)	40%
Indian ricegrass (Oryzopsis hymenoides)	30%
needle and thread grass (Stipa comata)	10%
western needlegrass (Stipa occidentalis)	10%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	2%
Nevada ephedra (Ephedra nevadensis)	2%
basin big sagebrush (Artemisia tridentata tridentata)	2%
annual forbs	2%
rubber rabbitbrush (Chrysothamnus nauseosus)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface.

Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is poorly suited for rangeland seeding due to the low precipitation and droughty surface layer. This unit has a severe limitation for fencing due to the loose, sandy textures and shallow bedrock of the Cashbaugh soil.
Range site name: Sandy 8-10" p.z. (NV-26-20)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the shallow bedrock of the Cashbaugh soil. The soil has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the shallow bedrock of the Cashbaugh soil and the sandy textures. Cuts needed to provide essentially level building sites can expose the shallow bedrock of the Cashbaugh soil. Cutbanks in the Brantel soil are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. The possibility of settlement can be minimized by compacting the building site before construction is begun. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
The Cashbaugh soil is in capability subclass VIIe(26), nonirrigated, and the Brantel soil is in capability unit IVe-1(26), nonirrigated. This unit is very poorly suited to irrigated agriculture due to the many shallow soils, rapid permeability, low available water capacity, short growing season, and the hazard of soil blowing.

* The Cashbaugh soil mapped in this unit is a taxadjunct to the Cashbaugh series because it contains more than 60 percent volcanic ash, has less than 0.4 percent organic carbon, and is underlain by hard rhyolitic tuff. These differences, however, do not greatly affect use and management.

118 - Chidago gravelly loamy sand, 2 to 9 percent slopes

Taxonomic Class:
Ashy, thermic Xeric Torripsamments

Setting:
This moderately deep, somewhat excessively drained soil is on undulating to gently rolling volcanic tablelands, north of Bishop. It formed in material weathered in place from soft, rhyolitic volcanic tuff. The native vegetation

is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,400 to 5,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 53 to 54°F, and the mean 32° frost-free season is about 150 days. A three-inch mantle of snow may cover this unit in winter for very brief periods. Mean annual snowfall is about 15 inches.

Typical Profile:
Typically, the soil surface is covered with about 20 percent pumice pebbles. The surface layer is light brown gravelly loamy sand about ½ inch thick. The next layer is light brown loamy sand about 8 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is pink loamy sand or gravelly loamy sand about 28 inches thick. Soft, pink rhyolitic tuff is at a depth of 36 inches in this typical profile, but can range from 20 to 40 inches deep. The soil below the surface layer contains about 10 percent pumice pebbles.

Inclusions:
Included in this unit are small areas of soils similar to the Chidago soil but 40 to 60 inches deep to the soft tuff, Hammil soils in drainageways, Honova soils on rocky knolls, soils similar to the Chidago soil that are calcareous or that have a thin hardpan on top of the soft tuff, and Buscones soils at the higher elevations. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Chidago soil is rapid (6-20 in/hr). The available water capacity is low (2.5-5.0 in). Effective rooting depth is 20 to 40 inches. The soil in noncalcareous and is neutral to mildly alkaline (pH 6.8-7.8). The organic carbon content is 0.1 to 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and pumice mining in some spots.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Fremont dalea (Dalea fremontii)	20%
fourwing saltbush (Atriplex canescens)	10%
Nevada ephedra (Ephedra nevadensis)	10%
Indian ricegrass (Oryzopsis hymenoides)	10%
desert needlegrass (Stipa speciosa)	10%
shadscale (Atriplex confertifolia)	5%
spiny hopsage (Grayia spinosa)	5%
common winterfat (Eurotia lanata)	5%
annual forbs	5%
Nevada dalea (Dalea polyadenia)	3%
bud sagebrush (Artemisia spinescens)	3%

spiny menodora (*Menodora spinescens*)		3%
longspine horsebrush (*Tetradymia axillaris*)		2%
staghorn cholla (*Opuntia echinocarpa*)		T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 5 to 20 percent of the soil surface. This unit is poorly suited for rangeland seeding due to the low precipitation and sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Ashy loamy sand 6-8" p.z. (CA-27-37)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the loose, sandy surface layer and dustiness. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Plate 11. Typical landscape of unit 118 on the Volcanic Tablelands, north of Bishop. Note the exposed soft tuff in middle ground. Looking southeast towards White Mountains.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the soil depth. Cuts needed to provide essentially level building sites can expose the soft tuff. Buildings and roads should be designed to offset the limited ability of soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Dirt roads on this unit usually do not have a water

erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the soil depth, low available water capacity, and the hazard of soil blowing.

119 - Cowtrack loamy sand, 2 to 30 percent slopes

Taxonomic Class:
Ashy over loamy, mixed, nonacid, frigid Xeric Torriorthents

Setting:
This deep, somewhat excessively drained, sandy soil is on high plateaus and hills southeast of Mono Lake. It formed in rhyolitic volcanic ash over material weathered in place from dacite, andesite, granitic, or basaltic bedrock. The topography is undulating to hilly. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 7,800 to 8,800 feet. The mean annual precipitation is 12 to 14 inches, the mean annual air temperature is about 40°F, and the mean 32° frost-free season is 75 to 100 days. A 2 to 3-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 80 to 110 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Plate 12. Typical landscape of unit 119 looking southeast over Granite Basin. Granite Mountain on left, Glass Mountain (with snow) on right.

Typical Profile:
Typically, the surface layer is light brownish gray loamy sand about 34 inches thick. The surface 2 or 3 inches has loose consistency. This layer is an overburden of airfall volcanic ash. It contains less than 5 percent pumice gravel. Below this is a buried subsoil of light brownish gray sandy loam about 16 inches thick. It contains about 5 percent gravel and 2 percent cobbles and stones. In some areas it is loam or sandy clay loam. The next layer is weathered dacite bedrock about 8 inches thick. Hard dacite bedrock occurs at a depth of 58 inches in this typical profile, but can range from 40 to 60 inches deep.

Inclusions:
Included with this unit are small areas of soils similar to the Cowtrack soil but with bedrock at a depth of 20 to 40 inches or at a depth of more than 60 inches, Zono soils at the lower elevations, Cowtrack Variant soils in small depressional areas, rock outcrops and shallow soils near hilltops, soils that have a cryic soil temperature regime above an elevation of 8,600 feet, and soils with slopes of less than 2 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Cowtrack soil is rapid (6-20 in/hr). The available water capacity is low to moderate (4.5-6.0 in). Effective rooting depth is 40 to 60 inches. Many roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous. The soil reaction is slightly acid to neutral (pH 6.1-7.0). The organic carbon content is about 0.5 percent. Runoff is very slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. The soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (Artemisa tridentata)	20%
antelope bitterbrush (Purshia tridentata)	20%
Indian ricegrass (Oryzopsis hymenoides)	20%
perennial forbs	10%
needle-and-thread grass (Stipa comata)	5%
western needlegrass (Stipa occidentalis)	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	3%
sulfur flower (Eriogonum umbellatum)	2%
basin wildrye (Elymus cinereus)	2%
curlleaf mountain mahogany (Cercocarpus ledifolius)	2%
blue wildrye (Elymus glaucus)	2%
common pricklygilia (Leptodactylon pungens)	2%

The annual production of air-dry vegetation ranges from 500 to 900 pounds per acre. Vegetation covers 30 to 40 percent of the soil surface. The suitability of this unit for rangeland seeding is poor due to the sandy

textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Ashy loamy sand 10-14" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the loose, sandy surface layer and steepness of slope in some areas. Off-pavement vehicle travel requires 4-wheel drive. The soil has low susceptibility to surface scarring by off-road vehicles. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitations are steep slopes in some areas, sandy textures, and hard bedrock at depths of 40 to 60 inches. Cuts needed to provide essentially level building sites can expose bedrock. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Access roads should be designed to control surface runoff and help stabilize cut slopes. Traction can be a problem on unimproved dirt roads unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping is in capability subclass VIe (26), nonirrigated. This unit is poorly suited for irrigated agriculture due to some steep slopes, the hazard of water erosion, and the short growing season.

120 - Cowtrack Variant gravelly coarse sand, 0 to 9 percent slopes

Taxonomic Class:
Ashy, frigid Xeric Torripsamments

Setting:
This very deep, somewhat excessively drained, sandy soil is on valley floors and fan terraces near Mono Lake. It formed in rhyolitic volcanic ash derived from airfall and alluvial ash deposits. The topography is nearly level to gently rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 7,600 to 8,200 feet. The mean annual precipitation is 12 to 14 inches, the mean annual air temperature is about 40°F, and the mean 32° frost-free season is 75 to 100 days. A 2 to 3-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is about 90 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the surface layer is light brownish gray gravelly coarse sand about 1 inch thick. The next layer is light brownish gray loamy coarse sand about 4 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light gray loamy coarse sand about 8 inches thick. The next layer to a depth of 60 inches or more is stratified loamy sand, gravelly loamy sand, gravelly loamy coarse sand, and gravelly coarse sand. The soil contains 5 to

35 percent fine and medium pumice and obsidian gravel. In some areas, the surface layer is loamy sand.

Inclusions:
Included with this unit are small areas of soils similar to the Cowtrack Variant soil but containing thin strata of very gravelly soil (Xeric Torriorthents), Cowtrack soils, Brantel soils at the lower elevations, Zono soils, Aquic Torriorthents in Big Sand Flat, and soils with slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Cowtrack Variant soil is rapid (6-20 in/hr). The available water capacity is moderate (5-6 in.) Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to mildly alkaline (pH 6.1-7.6). The organic carbon content is about 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (Artemisia tridentata)	30%
Thurbers needlegrass (Stipa thurberiana)	25%
antelope bitterbrush (Purshia tridentata)	10%
basin wildrye (Elymus cinereus)	10%
low sagebrush (Artemisia arbuscula)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
annual forbs	2%
perennial forbs	2%

The annual production of air-dry vegetation ranges from 500 to 700 pounds per acre. Vegetation covers about 30 percent of the soil surface. The suitability of this unit for rangeland seeding is fair to poor due to the sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Ashy loamy sand 10-14" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes. the main limitation is the loose, sandy surface layer. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites the main limitation is the sandy texture. The possibility of settlement can be minimized by compacting the

building site before construction begins. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Cutbanks are not stable and are subject to slumping. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability unit IVe-1(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the short growing season and sandy textures.

121 - Cryoborolls, extremely gravelly, 15 to 50 percent slopes

Taxonomic Class:
Cryoborolls

Setting:
These shallow to deep, well drained soils are on high elevation mountain slopes and plateaus in the Inyo Mountains. They formed in material weathered in place from metasedimentary or metavolcanic rock. The topography is hilly to steep. The native vegetation is mainly cool desert shrubs, perennial grasses, and forbs. Scattered groves of bristlecone pine (*Pinus aristata*) and limber pine (*Pinus flexilis*) occur on some of the shallower soils in this unit. Elevation is 9,600 to 11,100 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature is 32 to 37°F, and the mean 32° frost-free season is 10 to 75 days. A one-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 90 to 120 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly or very gravelly sandy loam. The subsoil is gravelly or very gravelly, sandy loam or sandy clay loam. Depth to hard, fractured bedrock ranges from 10 to 60 inches. The soils contain 15 to 60 percent rock fragments consisting of angular gravel and cobbles. In some areas, the subsoil is absent.

Inclusions:
Included in this unit are small areas of soils that are less than 10 inches deep or more than 60 inches deep, rock outcrops, frigid Haplargids and Torriorthents at the lower elevations, soils lacking a dark surface layer (Cryorthents), and soils that have slopes of less than 15 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of the Cryoborolls is moderately rapid to moderately slow (0.2-6.0 in/hr). The available water capacity is very low to low (1.0-5.0 in). Effective rooting depth is 10 to 60 inches. Many roots enter cracks in

the bedrock. The soil is noncalcareous, and is neutral to mildly alkaline (pH 6.6-7.3). The organic carbon content is 0.6 to 1.0 percent. Runoff is rapid. The water erosion condition is estimated as stable under native conditions and moderate under bare soil condition where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

subalpine big sagebrush (*Artemisia tridentata speciformis*)	25%
low sagebrush (*Artemisia arbuscula*)	15%
high altitude buckwheats (*Eriogonum sp.*)	15%
desert bitterbrush (*Purshia glandulosa*)	10%
Sandberg bluegrass (*Poa secunda*)	10%
junegrass (*Koeleria cristata*)	10%
perennial forbs	5%

Scattered groves of bristlecone pine (*Pinus aristata*) and limber pine (*Pinus flexilis*) occur on some of the shallower soils in this unit, with an understory of the above species. The annual production of air-dry vegetation ranges from 300 to 800 pounds per acre. Vegetation covers 15 to 35 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to many steep slopes and shallow soils. This unit has a moderate to severe limitation for fencing due to the many rock fragments, steep slopes, and many shallow soils.
Range site name: Subalpine forest 8-10" p.z. (CA-29-42)
Subalpine sagebrush 8-10" p.z. (CA-29-38)

Wood Products:
This unit is very poorly suited to the production of bristlecone-limber pine firewood, due to low productivity.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are steep slopes in some areas, many rock fragments, some shallow soils, and access difficulties. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are steep slopes in some areas, some shallow soils, and many rock fragments. Access roads should be designed to control surface runoff. Cuts needed to provide essentially level building sites can expose bedrock.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to many steep slopes, very short growing season, and many rock fragments.

122 - Cryoborolls, bouldery - Rock outcrop complex, 15 to 50 percent slopes

Taxonomic Class:
Cryoborolls

Setting:
This mapping unit is on rocky and bouldery mountain slopes and plateaus in the Inyo Mountains. The soils formed in material weathered in place from granitic rock. The topography is hilly to steep. The native vegetation is mainly cool desert shrubs, with perennial grasses and forbs. Scattered groves of limber pine (*Pinus flexilis*) occur on some of the shallower soils in this unit. Elevation is 9,600 to 11,100 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature is 32 to 37°F, and the mean 32° frost-free season is 10 to 75 days. A one-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 90 to 120 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Cryoborolls, bouldery and 20 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of rubbleland, soils that are shallower than 10 inches or deeper than 60 inches, soils lacking a dark surface layer (Cryorthents), frigid Torriorthents and Haplargids at the lower elevations, and soils that have slopes of less than 15 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Cryoborolls are shallow to deep and are well drained. The soil surface is covered with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 20 percent gravel. In some areas the surface stones and boulders are buried to varying depths or are piled one upon another to a height of 1 foot to 6 feet. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. A mat of decomposing pine needles is present beneath crowns of trees. The soil is stony to very bouldery loamy coarse sand or coarse sandy loam. Depth to decomposing granitic bedrock is 10 to 60 inches. The soils contain 15 to 60 percent rock fragments consisting of 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent gravel. Subsoils of sandy loam or sandy clay loam occur in some areas.

The rock outcrops cover 10 to 50 percent of the surface area, but the average coverage is about 20 percent. They project 3 to 20 feet above the soil surface.

Properties:
Permeability of the Cryoborolls is rapid (6-20 in/hr). Where subsoils of sandy clay loam occur, the permeability is moderately slow (0.2-0.6 in/hr). Available water capacity is very low to low (1.0-5.0 in). Effective rooting depth is 10 to 60 inches. Many roots enter cracks in the decomposing bedrock and can tap deeply percolating water. The soil is noncalcareous. The soil

reaction is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.6 to 1.0 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate to critical under bare soil conditions. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for wildlife habitat.

Plate 13. Typical landscape of unit 122 near New York Butte in the Inyo Mountains. Elevation is about 10,000 feet.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

subalpine big sagebrush (*Artemisia tridentata speciformis*)	25%
low sagebrush (*Artemisia arbuscula*)	15%
high altitude buckwheats (*Eriogonum sp.*)	15%
desert bitterbrush (*Purshia glandulosa*)	10%
Sandberg bluegrass (*Poa secunda*)	10%
junegrass (*Koeleria cristata*)	10%
perennial forbs	5%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	1%

Scattered groves of limber pine (*Pinus flexilis*) occur on some of the shallower soils in this unit, with an understory of the above species. The annual production of air-dry vegetation ranges from 300 to 800 pounds per acre. Vegetation covers 15 to 35 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to many steep slopes and shallow soils.

This unit has a moderate to severe limitation for fencing due to the many large rock fragments, steep slopes, and many shallow soils.
Range site name: Subalpine forest 8-10" p.z. (CA-29-42)
Subalpine sagebrush 8-10" p.z. (CA-29-38)

Wood Products:
This unit is very poorly suited to the production of limber pine firewood, due to low productivity.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are some steep slopes, many rock fragments, some shallow soils, and access difficulties.

Engineering Limitations:
If this unit is used for building sites, the main limitations are steep slopes in some areas, some shallow soils, many rock fragments, and rock outcrops. Access roads should be designed to control surface runoff. Cuts needed to provide essentially level building sites can expose bedrock.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to many steep slopes, very short growing season, and many large rock fragments.

123 - Durargids, shallow, 2 to 9 percent slopes

Taxonomic Class:
Durargids

Setting:
These shallow, well drained soils are on remnants of dissected alluvial fans in Owens Valley. The formed in alluvium derived dominantly from granitic rock sources. The topography is undulating to gently rolling. The native vegetation is mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,200 to 5,300 feet. The mean annual precipitation is 7 to 8 inches, the mean annual air temperature is 53 to 55°F, and the mean 32° frost-free season is 150 to 175 days. Mean annual snowfall is about 15 inches.

Typical Profile:
The surface layer is loamy coarse sand or gravelly loamy coarse sand. The next layer is sandy loam or gravelly sandy loam. It is usually a fragile layer with vesicular pores. The subsoil is clay, clay loam, sandy clay loam, or sandy loam. The next layer is a silica-cemented hardpan. The underlying material is sand or loamy coarse sand. The soil above the hardpan contains 5 to 35 percent rock fragments consisting of 1 to 3 percent boulders and stones, 1 to 10 percent cobbles and 5 to 25 percent gravel. Depth to the hardpan ranges from 10 to 20 inches. The hardpan is hard or very hard.

Inclusions:
Included in this unit are small areas of soils lacking hardpan (Xerollic Haplargids), soils lacking a clayey subsoil (Xerollic Durorthids), Thibau soils in drainageways, Rovana soils, Tuttle soils, Pajuela soils, Durargids

with a hardpan below a depth of 20 inches, and soils with slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of the Durargids soils is very slow (less than 0.06 in/hr). The available water capacity is very low to low (2-3 in). Effective rooting depth is 10 to 20 inches. The soil is noncalcareous. The soil reaction is neutral to mildly alkaline (pH 6.8-7.6). The organic carbon content is 0.2 to 0.5 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. Runoff is greatly increased if the subsoil or hardpan are exposed. The hazard of soil blowing is low under both native and bare soil conditions. Any soil loss on shallow soils can significantly reduce their long term productivity.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

blackbrush (Coleogyne ramosissima)	50%
white burrobush (Hymenoclea salsola)	10%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	10%
desert needlegrass (Stipa speciosa)	10%
Cooper goldenbush (Haplopappus cooperi)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
Nevada ephedra (Ephedra nevadensis)	3%
annual forbs	3%
spiny hopsage (Grayia spinosa)	1%

The annual production of air-dry vegetation is 200 to 400 pounds per acre. Vegetation covers 15 to 25 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation, shallow hardpan, and rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the shallow hardpan and shrink-swell potential of the subsoil. Range site name: Blackbrush fan 6-8" p.z. (CA-29-31)

Recreational Development:
It this unit is used for recreational purposes, the main limitations are the shallow hardpan, claypan, and dustiness. The vesicular layer is very dusty if disturbed. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the shallow hardpan and the claypan. Excavations may be impeded by the hardpan. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. This unit has a severe limitation for conventional septic tank systems due to the claypan and shallow hardpan. Absorption lines should be placed below the hardpan. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIe(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the shallow hardpan and rock fragments.

124 - Entic Durorthids - Typic Durorthids complex, cool, 5 to 50 percent slopes

Taxonomic Class:
Entic Durorthids
Typic Durorthids

Setting:
This mapping unit is on remnants of dissected fan terraces at the base of the Inyo-White Mountains in Owens Valley. The topography is gently rolling to steep. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,900 to 5,700 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 55 to 57°F, and the mean 32°frost-free season is 150 to 200 days. Mean annual snowfall is about 5 inches. The mean annual soil temperature is 59 to 62°F.

Percentages:
This unit is 60 percent Entic Durorthids and 20 percent Typic Durorthids. The Entic Durorthids are mainly on sideslopes and the Typic Durorthids are mainly on the ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Yermo soils, shallow soils over hard bedrock (Lithic Torriorthents), badland, soils similar to the Entic and Typic Durorthids but with slightly more rainfall and a slightly different plant community (Haploxerollic and Xerollic Durorthids), and soils with slopes of less than 5 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Entic Durorthids are shallow to moderately deep and are well drained. They formed in gravelly alluvium from mixed rock sources. The soil surface is covered with 50 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly sandy loam about 3 inches thick. It is a fragile layer with vesicular pores. The next layer is very gravelly sandy loam and stratified weak, platy hardpan. The underlying material is extremely gravelly sandy loam and loamy sand. The soil above the hardpan contains an average of 25 to 60 percent rock fragments consisting of angular gravel and angular cobbles. Depth to the hardpan ranges from 10 to 40 inches. In some areas the surface layer is cobbly sandy loam.

The Typic Durorthids are shallow or very shallow and are well drained. They formed in gravelly alluvium from mixed rock sources. The soil surface is covered with 50 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick.

The next layer is sandy loam or gravelly sandy loam about 4 inches thick. It is a fragile layer with vesicular pores. The next layer is a very hard, continuous hardpan that is estimated to be about 1 foot thick. The underlying material is estimated to be very gravelly or extremely gravelly sandy loam. The soil above the hardpan contains 15 to 60 percent rock fragments consisting of angular gravel and angular cobbles. Depth to the hardpan ranges from 4 to 20 inches. In some areas the surface layer is cobbly sandy loam.

Properties:
Permeability of the Entic Durorthids is moderately slow to slow (0.06-0.6 in/hr). The available water capacity is very low to low (0.8-3.0 in.) Effective rooting depth is 10 to 40 inches. Some roots penetrate the discontinuous hardpan through cracks and lenses of very gravelly sandy loam. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty is disturbed when it is dry.

Permeability of the Typic Durorthids is moderately rapid (2-6 in/hr) to a depth of about 4 inches and very slow (less than 0.06 in/hr) through the hardpan. The permeability is moderately rapid (2-6 in/hr) below the hardpan. The available water capacity is very low (0.3-1.5 in.). Effective rooting depth is 4 to 20 inches. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition is estimated as stable as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty is disturbed when it is dry.

Use:
At present, this unit is used for wildlife habitat, recreation, and limited grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (Atriplex confertifolia)	25%
white burrobush (Hymenoclea salsola)	15%
allscale saltbush (Atriplex polycarpa)	10%
desert needlegrass (Stipa speciosa)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
bud sagebrush (Artemisia spinescens)	5%
white bursage (Ambrosia dumosa)	5%
Fremont dalea (Dalea fremontii)	5%
annual forbs	3%
Nevada ephedra (Ephedra nevadensis)	3%
desert trumpet (Eriogonum inflatum)	1%
beavertail pricklypear (Opuntia basillaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the low precipitation, many shallow soils, and uneven topography. This unit has a severe limitation for fencing due to the hardpan and many small stones.
Range site name: Shadscale gravelly loam 4-6" p.z. (CA-29-39)

Plate 14. Typical landscape of unit 124 on east side of Owens Valley near Bishop. Yermo soils in foreground. Looking north along the White Mountains. Note off-road vehicle trails.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are some steep slopes, many rock fragments, and dustiness. Although the topography of this unit is well suited for off-road vehicle recreation, the soils have a high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are some steep slopes, many rock fragments, and hardpans. Excavations may be impeded by the hardpan. Absorption lines for septic tank absorption fields should be placed below the hardpan. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the hardpan, uneven topography, and many rock fragments.

125 - Pajuela very bouldery loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, thermic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans and fan terraces on the west side of Owens Valley and near the White Mountains. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans and fan terraces, which are joined together to form long bajadas, are incised with shallow washes and a few steep-sided drainageways. Stringers of stones and boulders radiate down the fans from the mouths of canyons. A few of the boulders are more than six feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation ranges from 4,000 to 5,500 feet. The mean annual precipitation ranges from 6 to 8 inches, the mean annual air temperature is 54 to 57°F, and the mean 32° frost-free season is 150 to 200 days. A 1 to 3-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with 15 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 10 to 20 percent fine gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is pale brown very bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is pale brown very stony, very cobbly, and extremely stony loamy coarse sand. This layer contains 35 to 80 percent rock fragments consisting of 10 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 10 to 20 percent gravel.

Inclusions:
Included in this unit are small areas of Pajuela soils with bouldery or extremely bouldery surface layers, soils similar to the Pajuela soil but with light sandy loam textures, Thibau soils, Tinemaha soils, Lubkin soils, Tuttle and Rovana soils at the higher elevations, rubbleland, moist soils along stream drainages, and soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Pajuela soil is rapid (6-20 in/hr). Available water capacity is very low (1.0-2.5 in). The soil is noncalcareous. The effective rooting depth is 60 inches or more. The soil reaction is neutral to mildly alkaline (pH 6.8-7.6). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community is mainly:

desert needlegrass (Stipa speciosa)	25%
spiny hopsage (Grayia spinosa)	20%
Nevada ephedra (Ephedra nevadensis)	15%
bud sagebrush (Artemisia spinescens)	5%
blackbrush (Coleogyne ramosissima)	5%
California buckwheat (Eriogonum fasciculatum)	5%
Indian ricegrass (Oryzopsis hymenodies)	5%
annual forbs	5%
common winterfat (Eurotia lanata)	3%
Cooper goldenbush (Haplopappus cooperi)	3%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	3%
white burrobush (Hymenoclea salsola)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the many rock fragments and sandy textures. This unit has a severe limitation for fencing due to the many large rock fragments.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Plate 15. Typical landscape of unit 125, looking north up Owens Valley. Sierra Nevada on left, Inyo Mountains on right.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many large rock fragments. Excavations are impeded by the many large rock fragments. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

126 - Pajuela - Thibau complex, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, thermic Xeric Torriorthents (Pajuela)
Sandy, mixed, thermic Xeric Torriorthents (Thibau)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces on the west side of Owens Valley and near the White Mountains. Most of these fans and fan terraces, which are joined together to form long bajadas, are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,000 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 54 to 57°F, and the mean 32° frost-free is 150 to 200 days. A 1 to 3-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Pajuela soil and 25 percent Thibau soil. The Pajuela soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of very bouldery Pajuela soils, soils similar to the Pajuela or Thibau soils that have coarse sandy loam textures, Tuttle and Rovana soils at the higher elevations, Tinemaha soils, Lubkin soils, rubbleland, moist soils along stream drainageways, and soils with slope of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Pajuela soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with 3 to 15 percent boulders and stones, 1 to 10 percent cobbles, and 10 to 20 percent gravel. The surface layer is brown bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is pale

brown very stony, very cobbly, or extremely stony loamy coarse sand. It contains 35 to 80 percent rock fragments consisting of 10 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 10 to 20 percent gravel.

The Thibau soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 1 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The surface layer is brown gravelly loamy coarse sand about 12 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is pale brown loamy coarse sand and gravelly loamy coarse sand about 30 inches thick. This layer contains about 28 percent rock fragments consisting of about 1 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The next layer to a depth of 60 inches or more is pale brown very cobbly loamy coarse sand, containing about 20 percent cobbles and 20 percent gravel.

Plate 16. Soil profile of the Pajuela soil in unit 126.

Properties:
Permeability of the Pajuela soil is rapid (6-20 in/hr). Available water capacity is very low (1.2-2.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Thibau soil is rapid (6-20 in/hr). Available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (Stipa speciosa)	25%
spiny hopsage (Grayia spinosa)	20%
Nevada ephedra (Ephedra nevadensis)	15%
bud sagebrush (Artemisia spinescens)	5%
blackbrush (Coleogyne ramosissima)	5%
California buckwheat (Eriogonum fasciculatum)	5%
longspine horsebrush (Tetradymia axillaris)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
Fremont dalea (Dalea fremontii)	5%
annual forbs	5%
common winterfat (Eurotia lanata)	3%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	3%
Cooper goldenbush (Haplopappus cooperi)	3%
white burrobush (Hymenoclea salsola)	2%
Anderson wolfberry (Lycium andersonii)	1%
shadscale (Atriplex confertifolia)	T

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is poorly or very poorly suited to rangeland seeding due to the sandy textures and many large rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many large rock fragments of the Pajuela soil and sandy textures.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the many large rock fragments in the Pajuela soil. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the many large rock fragments in the Goodale soil. Excavations are impeded by the many large rock fragments. Some cutbanks in the Thibau soil are not stable and are subject to slumping. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

127 - Halloran Variant very gravelly sand, 2 to 5 percent slopes

Taxonomic Class:
Coarse-loamy, mixed, thermic Typic Natrargids

Setting:
This deep, well drained soil is on old alluvial fan terraces near Owens Lake. It formed in alluvium from mixed rock sources. The topography is gently sloping. The native vegetation is salt and sodium-tolerant desert shrubs, perennial grasses, and annual forbs. Elevation is 3,600 to 3,800 feet. The mean annual precipitation is about 4 inches. The mean annual air temperature is about 59°F, and the mean 32° frost-free season is about 225 days. Mean annual snowfall is less than 2 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 50 percent gravel. The surface layer is light gray very gravelly sand about 1 inch thick. It contains about 50 percent gravel, with traces of cobbles and stones. The next layer is pale brown sandy loam about 7 inches thick. This is a fragile layer with vesicular pores. The subsoil is tough, pale brown sandy loam about 15 inches thick. The substratum is light gray loamy sand about 18 inches thick over a massive, continuous hardpan. Depth to the hardpan is 41 inches in this typical profile, but it can range from 40 to 60 inches deep. The soil averages about 5 percent rock fragments consisting of about 5 percent gravel and traces of cobbles and stones. In some areas the surface layer is cobbly sand.

Inclusions:
Included in this unit are small areas of saline-sodic Yellowrock soils, Halloran Variant soils lacking a hardpan, sand dunes, and soils with slopes of less than 2 or more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Halloran Variant soil is moderate (0.6-2.0 in/hr) due to the sodic subsoil. The permeability through the hardpan is very slow. The available water capacity is low (3-5 in). Effective rooting depth is 40 to 60 inches. The soil is calcareous throughout the profile. The soil reaction is very strongly alkaline (pH 9.0-10.5). The electrical conductivity of the saturation extract is 4 to 8 mmhos/cm (in the subsoil and substratum), and the exchangeable sodium percentage is 20 to 100 percent. The soil contains about 20 ppm of boron. The organic carbon content is less than 0.2 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions if the surface pavement is removed. This unit receives saline dust from Owens Lake playa during windy weather.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

allscale saltbush (*Atriplex polycarpa*)	40%
Mojave seablite (*Suaeda torreyana*)	10%
black greasewood (*Sarcobatus vermiculatus*)	10%
Parry saltbush (*Atriplex parryi*)	10%
annual forbs	5%
inland saltgrass (*Distichlis stricta*)	2%
Indian ricegrass (*Oryzopsis hymenoides*)	2%

The annual production of air-dry vegetation ranges from 10 to 50 pounds per acre. Vegetation covers less than 5 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and strong saline-sodic condition. This unit has a moderate limitation for fencing due to excess salts.
Range site name: Alkali sand 4-6" p.z. (CA-29-47)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the strong saline-sodic condition and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the strong saline-sodic conditions and the hardpan. Sulfate-resistant concrete should be used in any construction project. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(30), nonirrigated. This unit is poorly suited for irrigated agriculture due to the strong saline-sodic condition and the hardpan.

128 - Hammil gravelly loamy sand, 0 to 5 percent slopes

Taxonomic Class:
Ashy, thermic Xeric Torripsamments

Setting:
This very deep, somewhat excessively drained soil is in small valleys on the volcanic tablelands, north of Bishop. It formed in ashy alluvium derived dominantly from rhyolitic tuff in the tablelands. The native vegetation is mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,300 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 53 to 55°F, and the mean 32° frost-free season is about 150 days. Mean annual snowfall is about 15 inches. There is a rare hazard of flash-flooding in summer.

Typical Profile:
Typically, the surface layer is very pale brown gravelly loamy sand about ½-inch thick. The next layer to a depth of 60 inches or more is very pale brown loamy sand. The surface 2 or 3 inches has loose consistency. The soil contains about 10 percent pumice gravel overall. In some areas, the surface layer is loamy sand.

Inclusions:
Included in this unit are small areas of Chidago soils, Honova soils, soils with a hardpan (Xerollic Durorthids), soils that have substrata of loamy material (Xeric Torriorthents), soils that have mixed mineralogy, and soils that have slopes of more than 5 percent. Also included are small areas of Brantel loamy sand at the higher elevations. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Hammil soil is rapid (6-20 in/hr). The available water capacity is moderate (5-7 in). Effective rooting depth is 60 inches or more.The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

fourwing saltbush (Atriplex canescens)	20%
Indian ricegrass (Oryzopsis hymenoides)	20%
Fremont dalea (Dalea fremontii)	15%
Nevada ephedra (Ephedra nevadensis)	10%
desert needlegrass (Stipa speciosa)	10%
spiny hopsage (Grayia spinosa)	5%
annual forbs	5%

common winterfat (Eurotia lanata)	3%
longspine horsebrush (Tetradymia axillaris)	2%
bud sagebrush (Artemisia spinescens)	2%
shadscale (Atriplex confertifolia)	2%
Nevada dalea (Dalea polyadenia)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the low precipitation and sandy textures. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Ashy loamy sand 6-8" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the soil blowing hazard. The soil has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and rapid permeability. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(29), nonirrigated. This unit is moderately well suited for irrigated agriculture. It is limited by the small, irregular shapes of the areas, the soil blowing hazard, and rapid permeability.

129 - Haplargids - Torriorthents complex, frigid, 15 to 50 percent slopes

Taxonomic Class:
Haplargids
Torriorthents

Setting:
This mapping unit is on mountain slopes and plateaus in the Inyo Mountains. The topography is hilly to steep. The native vegetation is mainly cool desert shrubs with perennial grasses and forbs. Scattered groves of singleleaf pinyon (Pinus monophylla) and curlleaf mountainmahogany (Cercocarpus ledifolius) occur on this unit. Elevation is 8,000 to 9,600 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is 38 to 43°F, and the mean 32° frost-free season is 75 to 100 days. A one-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 60 to 90 inches. Some thundershowers occur

in summer, but they are infrequent and of limited extent. The mean annual soil temperature is 43 to 47°F.

Percentages:
This unit is 40 percent Haplargids and 35 percent Torriorthents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils with dark surface layers (Haploxerolls) under thick stands of pinyon pine, rock outcrops, very deep alluvial soils in drainageways, stony soils formed on granitic rock, Cryoborolls on some north slopes at the higher elevations, very shallow soils, and soils that have slopes of less than 15 or more than 50 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Haplargids are shallow to deep and are well drained. They formed in material weathered in place from metasedimentary and metavolcanic rock. The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly or very gravelly sandy loam. It is commonly a fragile layer with vesicular pores. The subsoil is gravelly or very gravelly sandy loam or sandy clay loam. The subsoil contains 15 to 60 percent rock fragments consisting of angular gravel and cobbles, with a few angular stones in some areas. Hard, fractured bedrock is at a depth of 10 to 60 inches.

The Torriorthents are shallow to deep and are well drained. They formed in material weathered in place from metasedimentary and metavolcanic rock. The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly and very gravelly sandy loam. A fragile layer with vesicular pores is common at the top of this layer. The lower layer contains 15 to 60 percent rock fragments consisting of angular gravel and cobbles, with a few angular stones in some areas. Hard, fractured bedrock is at a depth of 10 to 60 inches.

Properties:
Permeability of the Haplargids is moderately rapid to moderately slow (0.2-6.0 in/hr). Available water capacity is very low to moderate (1.0-6.0 in). Effective rooting depth is 10 to 60 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in most areas and is neutral to moderately alkaline (pH 6.8-8.0). The organic carbon content is 0.4 to 0.6 percent. Runoff is rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty is disturbed when dry.

Permeability of the Torriorthents is moderately rapid (2-6 in/hr). Available water capacity is low to very low (0.8-5.0 in). Effective rooting depth is 10 to 60 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in most areas and is

neutral to moderately alkaline (pH 6.8-8.0). The organic carbon content is 0.4 to 0.6 percent. Runoff is rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

Use:
At present, this unit is used for wildlife habitat.

Plate 17. Typical landscape of unit 129 in the Inyo Mountains. Note the extremely gravelly surface pavements. Looking north from an area around Mexican Spring. Note that many of the trees look rather young. Many pinyon pine trees were cut down in the southern Inyo Mountains in the late 1800's in order to support the vigorous mining activity in the area. The pinyon pine population is still recovering from these cuttings.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

subalpine big sagebrush (*Artemisia tridentata speciformis*)	30%
low sagebrush (*Artemisia arbuscula*)	15%
high-altitude buckwheats (*Eriogonum* sp.)	15%

desert bitterbrush (*Purshia glandulosa*)	10%
Sandberg bluegrass (*Poa secunda*)	10%
junegrass (*Koeleria cristata*)	10%
perennial forbs	5%

Open stands of singleleaf pinyon pine (*Pinus monophylla*) and curlleaf mountainmahogany (*Cercocarpus ledifolius*) grow on many of the shallower soils in this unit, with an understory of the above species. The annual production of air-dry vegetation ranges from 300 to 400 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to many steep slopes and many rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many small rock fragments and shallow soils.
Range site name: Subalpine sagebrush 8-10" p.z. (CA-29-38)
Mahogany slope 12-18" p.z. (NV-26-9)

Wood Products:
This unit is poorly suited to the production of pinyon pine firewood. It can produce 2 to 5 cords per acre in a stand of trees that average 5 inches in diameter at a height of 1 foot. The site index for this unit ranges from 25 to 35 in areas where pinyon pine grows.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are many steep slopes, many rock fragments, and access difficulties. This unit has high susceptibility to surface scarring by off-road vehicles. This unit is a source of pinyon pine nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are many steep slopes, many rock fragments, and some shallow soils. Cuts needed to provide essentially level building sites can expose bedrock. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many steep slopes, many rock fragments, many shallow soils, and the short growing season.

130 - Honova very cobbly loamy sand, 0 to 9 percent slopes

Taxonomic Class:
Loamy, mixed, nonacid, thermic Lithic Xeric Torriorthents

Setting:
This shallow or very shallow, well drained soil is on the volcanic tablelands, north of Bishop. The topography is nearly level to gently rolling. It formed in material weathered in place from hard rhyolitic volcanic tuff, with some eolian material from surrounding soils. The

landscape is broken by numerous steep, north-south trending fault escarpments that are 10 to 50 feet high. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. The elevation range is 4,300 to 5,700 feet. The mean annual precipitation is 6 to 8 inches, with some as snow. The mean annual air temperature is 54 to 56°F, and the mean 32° frost-free season is 150 to 175 days. A three-inch mantle of snow may cover this unit in winter for very brief periods. Mean annual snowfall is about 15 inches.

Typical Profile:
Typically, the soil surface is covered with about 45 percent angular rock fragments consisting of about 1 percent stones, 30 percent cobbles, and 15 percent gravel (all tuff fragments). The surface layer is pale brown very cobbly loamy sand about 3 inches thick. The next layer is light gray sandy loam and gravelly sandy loam about 4 inches thick. This layer is usually a fragile layer with vesicular pores. Hard, rhyolitic tuff bedrock is at a depth of 7 inches in this typical profile, but can range from 4 to 14 inches deep. Most of the rock fragments are in the surface layer. The lower layer contains an average of about 15 percent angular rock fragments consisting of about 1 percent stones, 5 percent cobbles, and 10 percent gravel (all tuff fragments).

Inclusions:
Included in this unit are small areas of soils that lack a vesicular layer and have loamy sand textures in the lower layer, soils that average more than 35 percent tuff fragments throughout the profile, soils that have sandy clay loam or sandy loam subsoils, rock outcrops and rubbleland on the steep fault scarps and fumarolic mounds, soils that are 14 to 40 inches deep over hard tuff, Chidago soils, Hammil soils in drainageways, soils similar to the Honova soils that are calcareous, soils that have a thin hardpan over the hard tuff, Sherwin soils at the higher elevations, and soils with slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Honova soil is moderately rapid (2-6 in/hr). The available water capacity is very low (0.3-1.5 in). Effective rooting depth is 4 to 14 inches. The soil is noncalcareous, and is neutral to mildly alkaline (pH 6.6-7.5). The organic carbon content of the surface layer is less than 0.3 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions. Removal of the surface rock pavement increases the water and wind erosion hazard. The vesicular layer is very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing, wildlife habitat, and some limited recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

little horsebrush (Tetradymia glabrata)	15%
blackbrush (Coleogyne ramosissima)	15%
spiny hopsage (Grayia spinosa)	10%
Nevada ephedra (Ephedra nevadensis)	10%
Fremont dalea (Dalea fremontii)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
common winterfat (Eurotia lanata)	5%
Nevada dalea (Dalea polyadenia)	5%
fourwing saltbush (Atriplex canescens)	5%
annual forbs	5%
shadscale (Atriplex confertifolia)	5%
longspine horsebrush (Tetradymia axillaris)	3%
desert needlegrass (Stipa speciosa)	2%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	T
spiny menodora (Menodora spinescens)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers about 20 percent of the soil surface. Shadscale grows in small areas where the soil is calcareous. This unit is very poorly suited to rangeland seeding due to the low precipitation, shallow soil depth, and many rock fragments. This unit has a severe limitation for fencing due to the shallow bedrock.
Range site name: Shallow loamy sand 6-8" p.z. (CA-29-36)

Plate 18. Typical landscape of unit 130 on the Volcanic Tablelands, north of Bishop. Note the hard volcanic tuff fragments in the surface layer and the north-south-trending fault scarps in middle ground. Looking northeast towards the White Mountains.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the shallow soil depth, many rock fragments, and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations is the shallow soil depth. Cuts needed to provide essentially level building sites can expose the hard tuff bedrock. The shallow bedrock increases the possibility of failure of conventional septic tank systems. Use of sandy backfill, long absorption lines, and trenches excavated into the bedrock helps to compensate for the shallow soil depth. Even so, effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. Roads should be designed to control surface runoff and avoid excess rilling.

Interpretive Groups:
This mapping unit is in capability class VIII. This unit is very poorly suited for irrigated agriculture due to the shallow soil depth and many rock fragments.

131 - Honova Variant loamy coarse sand, 2 to 9 percent slopes

Taxonomic Class:
Mixed, thermic, shallow Xeric Torripsamments

Setting:
This shallow or very shallow, somewhat excessively drained soil is on pediments around the Alabama Hills, in Owens Valley. It formed in material weathered in place from granitic rock. The topography is undulating to gently rolling. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 5,200 feet. The mean annual precipitation is about 6 inches, the mean annual air temperature is about 55°F, and the mean 32° frost-free season is about 200 days. Mean annual snowfall is 5 to 15 inches.

Typical Profile:
Typically, the surface layer is pale brown loamy coarse sand about 6 inches thick. Decomposing granitic bedrock is at a depth of 6 inches in this typical profile, but can range from 5 to 20 inches deep. The soil contains about 10 percent fine and medium granitic gravel. A fragile surface layer with vesicular pores is present in some areas.

Inclusions:
Included in this unit are small areas of shallow and moderately deep soils with sandy clay loam subsoils (Xeralific Haplargids), rock outcrops, Thibau soils in drainageways, and soils with slopes of less than 2 or more than 9 percent. The rock outcrops cover 0 to 20 percent of the surface area, but the total average coverage is about 5 percent. They project 5 to 50 feet above the surface. Included areas make up about 20 percent of the total acreage.

Properties:

Permeability of this Honova Variant soil is rapid (6-20 in/hr) above the decomposing bedrock. The available water capacity is very low (0.4-1.5 in). Effective rooting depth is 5 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in some areas. The soil reaction is mildly alkaline (pH 7.4-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions. Any soil loss on shallow soils can significantly reduce their long term productivity.

Use:

At present this unit is used for grazing, wildlife habitat, and some limited recreation.

Vegetation and Rangeland:

The potential plant community on this unit is mainly:

shadscale (*Atriplex confertifolia*)	15%
spiny hopsage (*Grayia spinosa*)	10%
desert needlegrass (*Stipa speciosa*)	10%
bud sagebrush (*Artemisia spinescens*)	10%
Nevada ephedra (*Ephedra nevadensis*)	10%
white burrobush (*Hymenoclea salsola*)	10%
common winterfat (*Eurotia lanata*)	5%
Cooper goldenbush (*Haplopappus cooperi*)	5%
allscale saltbush (*Atriplex polycarpa*)	5%
longspine horsebrush (*Tetradymia axillaris*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
Anderson wolfbery (*Prunus andersonii*)	2%
white bursage (*Franseria dumosa*)	2%

The annual production of air-dry vegetation is 100 to 200 pounds per acre. Vegetation covers 10 to 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to low precipitation, sandy textures, and shallow soil depth. This unit has a severe limitation for fencing due to the shallow bedrock.

Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:

If this unit is used for recreational purposes, the main limitations are the sandy texture and shallow soil depth. This unit has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:

If this unit is used for building sites, the main limitation is the shallow soil depth. Cuts needed to provide essentially level building sites can expose bedrock. This unit has a severe limitation for conventional septic tank systems.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the shallow soil depth, uneven topography, and some rock outcrops.

132 - Hoye Variant loam, 0 to 2 percent slopes

Taxonomic Class:
Fine-loamy, mixed, mesic Xeralfic Haplargids

Setting:
This very deep, well drained soil is on valley floors in the Benton area. It formed in mixed alluvium derived dominantly from basalt, granitic, and pyroclastic rock sources. The soil contains some rhyolitic volcanic ash. The native vegetation is cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,300 to 5,600 feet. The mean annual precipitation is 8 to 9 inches, the mean annual air temperature is about 51°F, and the mean 32° frost-free season is 125 to 150 days. A 6-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 30 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the surface layer is pale brown heavy loam about 7 inches thick. The subsoil is brown loam or silty clay loam about 14 inches thick. The next layer is white fine sandy loam about 2 inches thick. The next layer is brown clay about 10 inches thick. In many areas, this is a buried subsoil. The substratum to a depth of 60 inches or more is pale brown silt loam. In some areas, the surface layer is fine sandy loam.

Inclusions:
Included with this unit are small areas of Brantel loamy sand, soils with silt loam textures throughout the profile, and soils that are moderately affected by salts and sodium. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Hoye Variant soil is very slow (0.06-0.6 in/hr). The available water capacity is high to very high (9-11 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is neutral to moderate alkaline (pH 6.6-8.2). The electrical conductivity of the saturation extract is 0.5 to 4 mmhos/cm, and the exchangeable sodium percentage is 3 to 12 percent. The soil contains 0.1 to 2 ppm of boron. The organic carbon content is 0.4 to 0.6 percent. Runoff is very slow or ponded. Runoff water may pond on this unit in very wet years. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for irrigated alfalfa, wildlife habitat, and grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

common winterfat (Eurotia lanata)	45%
fourwing saltbush (Atriplex canescens)	10%
big sagebrush (Artemisia tridentata)	10%
Indian ricegrass (Oryzopsis hymenoides)	10%
annual forbs	10%
galleta grass (Hilaria jamesii)	5%

Areas that have been cultivated in the past support Russian thistle (Salsola sp.), black greasewood (Sarcobatus vermiculatus), and annual forbs. The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers about 20 percent of the soil surface. This unit is poorly suited to rangeland seeding due to the low precipitation. This unit is suited for fencing.
Range site name: Loamy flat 6-8" p.z. (CA-29-49)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are slow permeability, dustiness, and rare periods of flooding. This unit has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the rare periods of flooding and slow subsoil permeability. If this soil is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field. Use of sandy backfill for the trench helps to compensate for the slow permeability.

Interpretive Groups:
This mapping unit is in capability unit IIs-3(26), irrigated and subclass VIs(26), nonirrigated. This unit is well suited for irrigated agriculture. It is limited only by the heavy textured subsoil, some slightly saline-sodic areas, and some possible soil blowing problems.

133 - Wellington* very gravelly loamy sand, moist, 2 to 9 percent slopes

Taxonomic Class:
Loamy, mixed, mesic, shallow Xerollic Durargids

Setting:
This shallow, well drained soil is on alluvial fan terraces near the Benton Range. It formed in alluvium from mixed rock sources. Some rhyolitic volcanic ash is in the surface layer. The topography is gently to moderately sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevations is 5,600 to 6,800 feet. The mean annual precipitation is 9 to 10 inches, the mean annual air temperature is 48 to 50°F, and the mean 32° frost-free season is 125 to 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 40 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 1 percent cobbles and 50 percent gravel. The surface layer is light gray very gravelly loamy sand about 1 inch thick. A fragile surface layer with vesicular pores is present in some areas. The next layer is light gray loamy sand about 4 inches thick. The subsoil is light yellowish brown sandy clay loam or loam about 8 inches thick. The next layer is a very hard, continuous, silica-cemented hardpan, 10 to 30 inches thick. The soil below the surface layer contains about 10 percent rock fragments consisting of about 1 percent cobbles and 5 percent gravel. The hardpan is at a depth of 13 inches in this typical profile, but can range from 10 to 20 inches deep. In some areas, the surface layer is very gravelly silt loam.

Inclusions:
Included in this unit are small areas of soils lacking hardpans, soils with the hardpan at a depth of less than 10 or more than 20 inches, soils lacking a dense subsoil, stony Wellington soils, Sawavu soils, soils that have slopes of less than 2 or more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Wellington soil is very slow (less than 0.06 in/hr) due to the hardpan. Available water capacity is very low (1.0-2.5 in). Effective rooting depth is 10 to 20 inches. Some roots penetrate the hardpan through cracks. The soil is noncalcareous. The soil reaction is neutral to mildly alkaline (pH 6.6-7.6). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions. Any soil loss on shallow soils can significantly reduce their long-term productivity.

Use:
At present, this unit is used for wildlife habitat and grazing.

Vegetation and Rangeland:
The potential plant community of this unit is mainly:

mountain big sagebrush (Artemisia tridentata vaseyana)	25%
desert bitterbrush (Purshia glandulosa)	25%
desert needlegrass (Stipa speciosa)	20%
Indian ricegrass (Oryzopsis hymenoides)	5%
Nevada ephedra (Ephedra nevadensis)	5%
perennial forbs	5%
annual forbs	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	2%
spiny hopsage (Grayia spinosa)	1%
common winterfat (Eurotia lanata)	1%

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 15 to 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the shallow hardpan. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas.

This unit has a severe limitation for fencing due to the shallow hardpan. Range site name: Stony granitic fan 8-10" p.z. (CA-29-33)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are shallow soil depth, possible flash flooding, and dustiness. The vesicular layer is very dusty if disturbed. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the shallow hardpan and dense subsoil. Excavation for building sites is impeded by the hardpan. The suitability of the soil for septic tank absorption fields can be improved by ripping through the hardpan to increase permeability.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is very poorly suited to irrigated agriculture due to the shallow hardpan.

* The Wellington soil mapped in this unit is a taxadjunct of the Wellington series because it contains some volcanic ash, has very gravelly surface textures, does not have an E horizon, and is not underlain by silty lacustrine material.

134 - Wellington* very gravelly loamy sand, dry, 2 to 9 percent slopes

Taxonomic Class:
Loamy, mixed, mesic, shallow Xerollic Durargids

Setting:
This shallow, well drained soil is on alluvial fan terraces near the Benton Range. It formed in alluvium derived dominantly from basaltic rock sources. Some rhyolitic volcanic ash is in the surface layer. The topography is gently to moderately sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevations is 5,600 to 6,800 feet. The mean annual precipitation is 8 to 9 inches, the mean annual air temperature is 48 to 50°F, and the mean 32° frost-free season is 125 to 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 30 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 1 percent angular stones, and 5 percent cobbles, and 40 percent angular gravel. The surface layer is light gray very gravelly loamy sand about 1 inch thick. A fragile layer with vesicular pores is present in some areas. The next layer is light gray loamy sand about 6 inches thick. The subsoil is very pale brown sandy clay loam about 8 inches thick. The next layer is a very hard, continuous, silica-cemented hardpan, 10 to 30 inches thick. The soil below the surface layer contains about 10 percent rock fragments consisting of about 1 percent stones, and 5 percent cobbles, and 5 percent gravel. The hardpan is at a

depth of 15 inches in this typical profile, but can range from 10 to 20 inches deep. In some areas, the surface layer is stony loamy sand.

Inclusions:
Included in this unit are small areas of soils lacking a hardpan, soils with the hardpan at a depth of less than 10 or more than 20 inches, Sawavu soils, soils that have slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Wellington soil is very slow (less than 0.06 in/hr) due to the hardpan. Available water capacity is very low (1.0-2.5 in). Effective rooting depth is 10 to 20 inches. Some roots penetrate the hardpan through cracks. The soil is noncalcareous. The soil reaction is neutral to mildly alkaline (pH 6.6-7.6). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions. The hazard of soil blowing decreases with increasing surface coverage of rock fragments. Any soil loss on shallow soils can significantly reduce their long-term productivity.

Use:
At present, this unit is used for wildlife habitat and grazing.

Vegetation and Rangeland:
The potential plant community of this unit is mainly:

Wyoming big sagebrush (Artemisia tridentata wyomingensis)	30%
galleta grass (Hilaria jamesii)	20%
Nevada ephedra (Ephedra nevadensis)	10%
spiny hopsage (Grayia spinosa)	10%
desert needlegrass (Stipa speciosa)	5%
perennial forbs	5%
common winterfat (Eurotia lanata)	5%
annual forbs	5%
Indian ricegrass (Oryzopsis hymenoides)	3%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	2%
rubber rabbitbrush (Chrysothamnus nauseosus)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 15 to 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the shallow hardpan. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the shallow hardpan. Range site name: Stony granitic fan 8-10" p.z. (CA-29-33)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the shallow hardpan, dustiness, possible flash flooding, and some surface stones. The vesicular layer is very dusty if disturbed. This unit has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the shallow hardpan and dense subsoil. Excavation for building sites is impeded by the hardpan. The suitability of the soil for septic tank absorption fields can be improved by ripping through the hardpan to increase permeability.

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the shallow hardpan.

* The Wellington soil mapped in this unit is a taxadjunct of the Wellington series because it contains some volcanic ash, has very gravelly surface textures, does not have an E horizon, and is not underlain by silty lacustrine material.

135 - Lithic Torriorthents - Lithic Haplargids - Rock outcrop complex, thermic, 30 to 75 percent slopes

Taxonomic Class:
Lithic Torriorthents
Lithic Haplargids

Setting:
This mapping unit is on hillsides in the Inyo-White Mountains, Alabama Hills, and Poverty Hills. The topography is steep to very steep. The native vegetation in mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,700 to 6,400 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 54 to 59°F, and the mean 32° frost-free season is 150 to 200 days. Mean annual snowfall under 10 inches. The mean annual soil temperature is 59 to 65°F.

Percentages:
This unit is 40 percent Lithic Torriorthents, 20 percent Lithic Haplargids, and 15 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Lithic Xeric Torriorthents and Lithic Xerollic Haplargids in a 6 to 8 inch precipitation zone at the higher elevations and at the northerly portions of this unit, soils deeper than 20 inches (mainly at the bases of hills and in swales), Yermo soils in canyon bottoms, soils with cool desert shrub vegetation (mesic soil temp. regime) at the higher elevations, and soils with slopes of less than 30 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Lithic Torriorthents are shallow or very shallow and are well drained. They formed in material weathered in place from metasedimentary, metavolcanic, or granitic rock. The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly, sandy loam or silt loam about 1 inch thick. The next

layer is gravelly or very gravelly, sandy loam or silt loam about 2 inches thick. It is commonly a fragile layer with vesicular pores. The next layer is gravelly or very gravelly, sandy loam or silt loam. The lower layer contains 15 to 60 percent rock fragments consisting of angular gravel and cobbles with a few angular stones in some areas. Hard bedrock occurs at a depth of 3 to 20 inches. Granitic areas have more cobbles, stones, and boulders present, and textures are loamy coarse sand or coarse sandy loam.

The Lithic Haplargids are shallow or very shallow and are well drained. The formed in material weathered in place from metasedimentary, metavolcanic, or granitic rock. The soil surface is covered with 40 to 80 percent angular gravel and angular cobbles. The surface layer is very gravelly or extremely gravelly, sandy loam or silt loam about 1 inch thick. The next layer is gravelly sandy loam or silt loam about 3 inches thick. It is commonly a fragile layer with vesicular pores. The subsoil is gravelly or very gravelly, silty clay loam or sandy clay loam. It contains 15 to 60 percent rock fragments consisting of angular gravel and cobbles, with a few angular stones in some areas. Hard bedrock is at a depth of 7 to 20 inches. On some nearly level benches the subsoil is clay or sandy clay. Granitic areas have more cobbles, stones, and boulders present, and surface textures are loamy coarse sand or coarse sandy loam.

Properties:
Permeability of the Lithic Torriorthents is moderate to moderately rapid (0.6-6.0 in/hr). Available water capacity is very low (0.2-1.5 in). Effective rooting depth is 3 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The electrical conductivity of the saturation extract is 0.5 to 2.0 mmhos/cm and the exchangeable sodium percentage is 5 to 20 percent. The soil contains 1 to 6 ppm of boron. The organic matter content is less than 0.3 percent. Runoff is rapid or very rapid. The water erosion condition class is estimated as stable under native conditions and is moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil condition. However, the soil is very dusty if disturbed when dry.

Permeability of the Lithic Haplargids is moderately slow (0.2-0.6 in/hr). Available water capacity is very low (0.5-2.0 in). Effective rooting depth is 7 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The electrical conductivity of the saturation extract is 0.5 to 2.0 mmhos/cm and the exchangeable sodium percentage is 5 to 20 percent. The soil contains 1 to 6 ppm of boron. The organic carbon content is less than 0.3 percent. Runoff is rapid or very rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

The rock outcrops cover 5 to 50 percent of the surface, but the total average coverage is about 15 percent. The rock outcrops project 1 to 20 feet above the soil surface.

Use:
At present, this unit is used for wildlife habitat and limited grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (Atriplex confertifolia)	25%
Nevada ephedra (Ephedra nevadensis)	10%
Fremont dalea (Dalea fremontii)	10%
white bursage (Franseria dumosa)	10%
desert needlegrass (Stipa speciosa)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
annual forbs	5%
California buckwheat (Eriogonum fasciculatum)	5%
spiny hopsage (Grayia spinosa)	3%
longspine horsebrush (Tetradymia axillaris)	2%
Cooper goldenbush (Haplopappus cooperi)	2%
desert trumpet (Eriogonum inflatum)	1%
desert peach (Prunus andersonii)	1%

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 10 to 20 percent of the surface area. This unit is very poorly suited to rangeland seeding due to the low precipitation, steep slopes, and shallow soils. This unit has a severe limitation for fencing due to the shallow soil depth, many rock outcrops, and steep slopes.
Range site name: Upland arid loam 4-6" p.z. (CA-29-44)

Plate 19. Typical landscape of unit 135 in southern Inyo Mountains. Looking southwest across Owens Lake (dry) towards the Sierra Nevada.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the steep slopes, shallow soils, and many rock fragments. This unit has high susceptibility to surface scarring by off-road vehicles. The vesicular layer is very dusty if disturbed.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the steep slopes, shallow soils, and many rock fragments. Cuts needed to provide essentially level building sites can expose bedrock. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability class VIII. This unit is very poorly suited for irrigated agriculture due to the shallow soils and steep slopes.

136 - Lithic Xerollic Haplargids - Lithic Xeric Torriorthents complex, mesic, 30 to 75 percent slopes

Taxonomic Class:
Lithic Xerollic Haplargids
Lithic Xeric Torriorthents

Setting:
This mapping unit is on hillsides in the Inyo-White Mountains and the Benton Range. The topography is steep to very steep. The native vegetation is mainly cool desert shrubs, perennial grasses,and annual forbs. Scattered groves of singleleaf pinyon pine (Pinus monophylla) occur in some areas. Elevation is 5,600 to 8,500 feet. The mean annual precipitation is 6 to 10 inches, the mean annual air temperature is 43 to 53°F, and the mean 32° frost-free season is 100 to 150 days. A 6-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 20 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. The mean annual soil temperature is 47 to 59°F.

Percentages:
This unit is 40 percent Lithic Xerollic Haplargids and 35 percent Lithic Xeric Torriorthents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of rock outcrops, soils that are deeper than 20 inches (mainly in swales and at bases of hills), Dotard soils in canyon bottoms, soils with dark surface layers (Haploxerolls) under thick stands of pinyon pine, soils with a frigid soil temperature regime at the higher elevations, very stony talus piles with very steep slopes, and soils with slopes of less than 30 or more than 75 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Lithic Xerollic Haplargids are shallow or very shallow and are well drained. They formed in material weathered in place from metasedimentary or

metavolcanic rock. The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly, sandy loam or loam about 1 inch thick. The next layer is very gravelly sandy loam or loam about 2 inches thick. It is commonly a fragile layer that has vesicular pores. The subsoil is gravelly, cobbly, or very gravelly, silty clay loam or sandy clay loam. Some subsoils on moderately sloping benches have clay loam textures. The soil contains 15 to 60 percent rock fragment consisting of angular gravel and cobbles, with a few angular stones in some areas. Hard, fractured bedrock occurs at a depth of 7 to 20 inches.

The Lithic Xeric Torriorthents are shallow or very shallow and are well drained. They formed in material weathered in place from metasedimentary or metavolcanic rock. The soil surface is covered with 40 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly loam or sandy loam about 2 inches thick. It is commonly a fragile layer that has vesicular pores. The next layer is gravelly or very gravelly sandy loam. The lower layers contain 15 to 60 percent rock fragments consisting of angular gravel and cobbles, with a few angular stones in some areas. Hard, fractured bedrock occurs at a depth of 3 to 20 inches.

Plate 20. Typical landscape of unit 136 in southern Inyo Mountains. Elevation is about 8,400 feet. Looking northwest towards New York Butte.

Properties:
Permeability of the Lithic Xerollic Haplargids is moderately slow (0.2-0.6 in/hr). Available water capacity is very low (0.5-2.0 in). Effective rooting depth is 7 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in most areas and

is mildly to moderately alkaline (pH 7.4-8.4). The organic carbon content is 0.4 to 0.6 percent. Runoff is rapid or very rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

Permeability of the Lithic Xeric Torriorthents is moderately rapid to moderate(0.06-6.0 in/hr). Available water capacity is very low (0.2-1.5 in). Effective rooting depth is 3 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in most areas and is mildly to moderately alkaline (pH 7.4-8.4). The organic carbon content is 0.4 to 0.6 percent. Runoff is rapid or very rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

Use:
At present, this unit is used for wildlife habitat and limited grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	20%
desert needlegrass (*Stipa speciosa*)	15%
green Mormon tea (*Ephedra viridis*)	10%
desert bitterbrush (*Purshia glandulosa*)	10%
singleleaf pinyon pine (*Pinus monophylla*)	10%
Douglas rabbitbrush (*Chrysothamnus nauseosus*)	5%
bottlebrush squirreltail (*Sitanion hystrix*)	5%
annual forbs	5%
spiny hopsage (*Grayia spinosa*)	5%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	3%
Nevada ephedra (*Ephedra nevadensis*)	2%
Indian ricegrass (*Oryzopsis hymenoides*)	2%

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 25 to 30 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the steep slopes and shallow soils. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the shallow soil depths, steep slopes, and some rock outcrops.
Range site name: Steep sandy slope 8-10" p.z. (CA-29-34)
Semi-arid loamy slope 8-12" p.z. (NV-29-20)

Wood Products:
This unit is poorly suited to the production of pinyon pine firewood. The site index for this unit is 20 to 30. It can produce 2 to 5 cords per acre in a stand of trees that average 5 inches in diameter at a height of 1 foot.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are steep slopes, shallow soils, and many rock fragments. This unit has high

susceptibility to surface scarring by off-road vehicles. The vesicular layer is very dusty if disturbed when dry. This unit is a source of pinyon nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are steep slopes, shallow soils, and many rock fragments. Cuts needed to provide essentially level building sites can expose bedrock. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many steep slopes, many rock fragments, shallow soil depth, and short growing season.

Plate 21. An overhead view of the surface pavement that is typical of the soils in units 121, 129, 135, and 136.

137 - Haar family soils, 2 to 15 percent slopes

Taxonomic Class:
Loamy, mixed, nonacid, mesic, shallow Xeric Torriorthents

Setting:
These shallow and very shallow, well drained soils are on mountain plateaus of the Sierra Nevada and the Benton Range. They formed in material weathered in place from granitic rock. The topography is undulating to rolling. The native vegetation is cool desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 7,000 feet. The mean annual precipitation is 7 to 10 inches, the mean annual air temperature is 48 to 53°F, and the mean 32° frost-free season is 100 to 160 days. A 6-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 25 to 50 inches.

Typical Profile:
Typically, the surface layer is loamy coarse sand or gravelly loamy coarse sand about 2 inches thick. The next layer is coarse sandy loam. Decomposing granitic bedrock is at a depth of 4 to 20 inches. The surface 2 or 3 inches has loose consistency. The soil contains about 15 percent gravel overall. In some areas the surface layer is bouldery loamy coarse sand.

Inclusions:
Included in this unit are small areas of Glenbrook family soils, shallow soils with sandy clay loam subsoils (Xeralfic Haplargids), rock outcrops, Berent family soils, and soils with slopes of less than 2 or more than 15 percent. Rock outcrops cover 1 to 10 percent of the surface in some areas, but the total average coverage is about 3 percent. They project 1 to 10 feet above the surface. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of these soils is moderately rapid (2-6 in/hr). The available water capacity is very low (0.3-2.0 in). Effective rooting depth is 4 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.2 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. Compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use: At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (*Stipa speciosa*)	25%
big sagebrush (*Artimisia tridentata*)	20%
blackbrush (*Coleogyne ramosissima*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%

Nevada ephedra (*Ephedra nevadensis*)	5%
desert bitterbrush (*Purshia glandulosa*)	5%
bottlebrush squirreltail (*Sitanion hystrix*)	5%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	3%
spiny hopsage (*Grayia spinosa*)	3%
annual forbs	3%

The annual production of air-dry vegetation ranges from 200 to 500 pounds per acre. Vegetation covers 15 to 20 percent of the soil surface. Soils in the 7 to 8 inch precipitation zone support a higher proportion of blackbrush, Nevada ephedra, and spiny hopsage. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited for rangeland seeding due to low precipitation and shallow soil depth. This unit has a moderate to severe limitation for fencing due to the shallow soil depth.
Range site name: Stony granitic fan 8-10" p.z. (CA-29-33)
Blackbrush fan 6-8" p.z. (CA-29-31)

Recreational Development:
If this unit is used for recreational development, the main limitation is the shallow soil depth. The vesicular layer is very dusty if disturbed. This unit has high susceptibility to surface scarring by off-road vehicles.

Plate 22. Typical landscape of unit 137 in the Tungsten Hills, west of Bishop. Looking northwest towards the Sierra Nevada (Wheeler Crest).

Engineering Limitations:
If this unit is used for building sites, the main limitation is the shallow soil depth. Cuts needed to provide essentially level building sites can expose bedrock. Because of the shallow soil depth, this unit has a severe

limitation for conventional septic tank systems. Access roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the shallow soil depth and some rock outcrops.

138 - Xeric Torriorthents, very bouldery - Rock outcrop complex, 15 to 50 percent slopes

Taxonomic Class:
Xeric Torriorthents

Setting:
This mapping unit is on hilly to steep mountainsides in the Benton Range and Inyo Mountains. The native vegetation is mainly scattered pinyon pine with an understory of cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,500 to 8,800 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 43 to 53°F, and the mean 32° frost-free season is 50 to 150 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Xeric Torriorthents, very bouldery and 20 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Haar family soils, Glenbrook family soils, Berent family soils, soils with a thick dark surface layer, soils with a sandy clay loam subsoil (Xerollic Haplargids), Rovana soils in drainageways, rubbleland, and soils with slopes of less than 15 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Xeric Torriorthents are very shallow to moderately deep and are well drained or somewhat excessively drained. They formed in material weathered in place from granitic rock. A thin mat of decomposing pine needles is present beneath crowns of trees. The soil is very bouldery coarse sandy loam or loamy coarse sand. Decomposing granitic bedrock is at a depth of 4 to 40 inches. The soil contains 15 to 50 percent rock fragments consisting of 3 to 25 percent boulders and stones, 0 to 10 percent cobbles, and 5 to 15 percent gravel. Some of the boulders exceed six feet in diameter. In some areas, the surface layer is bouldery coarse sandy loam or loamy coarse sand. Where this unit occurs near Adobe Valley, the soils contain volcanic ash.

Rock outcrop consists of bare exposures of hard, granitic bedrock projecting 3 to 20 feet above the surface. Little or no soil is present. The outcrops can cover 15 to 50 percent of the surface, but the average coverage is about 20 percent.

Properties:
Permeability of the Xeric Torriorthents is moderately rapid to rapid (2-6 in/hr). The available water capacity is very low (0.3-2.0 in). Effective rooting depth is 4 to 40 inches. Some roots enter cracks in the decomposing bedrock and can tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.4 to 0.6 percent. Runoff is medium to rapid. The water erosion condition class is estimated as stable under native conditions and slight to moderate under bare soil conditions. The soils are very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of these noncohesive soils. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

singleleaf pinyon pine (*Pinus monophylla*)	20%
big sagebrush (*Artemisia tridentata*)	20%
desert needlegrass (*Stipa speciosa*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%
desert bitterbrush (*Purshia glandulosa*)	10%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	5%
green Mormon tea (*Ephedra viridis*)	5%
buckwheats (*Eriogonum* sp.)	5%
annual forbs	5%
bottlebrush squirreltail (*Sitanion hystrix*)	3%

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 15 to 25 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the many rock outcrops, large rock fragments, and steep slopes. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to many rock outcrops, large rock fragments, and some shallow soils.
Range site name: Rocky upland loam 8-12" p.z. (CA-26-42)

Wood Products:
This unit is poorly suited to the production of pinyon firewood. It can produce 2 to 5 cords per acre in a stand of trees that average 5 inches in diameter at a height of 1 foot. The site index for this unit ranges from 25 to 35.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are shallow soil depth, steep slopes in some areas, and many rock outcrops and large rock fragments. This unit is a source of pinyon pine nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are shallow soil depth, steep slopes in some areas, and many rock outcrops and large rock fragments. Cuts needed to provide essentially level building sites can expose bedrock. Excavations may be impeded by the many large rock fragments and rock outcrops.

Interpretive Groups:
This mapping unit is in capability class VIII. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments, rock outcrops, steep slopes, and short growing season.

139 - Millner association, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed (calcareous), thermic Xeric Torriorthents

Setting:
This mapping unit is on alluvial fans at the base of the White Mountains. Most of these fans are joined together to form long bajadas and are incised with shallow washes and a few steep-sided drainageways. The topography is moderately to strongly sloping. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,400 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperatures is 54 to 56°F, and the mean 32° frost-free season is about 150 days. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Millner very gravelly sandy loam and 30 percent Millner stony sandy loam. Millner very gravelly sandy loam is on the lower and middle parts of the alluvial fans, and Millner stony sandy loam is on the higher parts of the fans and on some low stony ridges that radiate down the fans.

Inclusions:
Included in this unit are small areas of soils similar to the Millner soil but with less than 35 percent rock fragments, soils with very gravelly loamy sand substrata, Dotard soils at the higher elevations, Yermo soils at the lower elevations, soils with slopes of less than 5 or more than 15 percent, and recent unvegetated mudflows. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Millner very gravelly soil is very deep and well drained. It formed in gravelly alluvium from metasedimentary and metavolcanic rock sources. Typically, the soil surface is covered with about 1 percent angular stones, 10 percent angular cobbles, and 40 percent angular gravel. The surface layer is pale brown very gravelly sandy loam about 1 inch thick. The next layer is pale brown gravelly sandy loam about 7 inches thick. The next layer is pale brown very gravelly fine sandy loam about 25 inches thick. The next layer to a depth of 60 inches or more is stratified light yellowish brown cobbly sandy

loam and sandy loam. The soil between depths of 10 and 40 inches contains an average of about 40 percent rock fragments consisting of about 1 percent angular stones, 15 percent angular cobbles, and 25 percent angular gravel. In some areas, the surface layer is gravelly sandy loam.

The Millner stony soil is very deep and well drained. It formed in stony and gravelly alluvium from metasedimentary and metavolcanic rock sources. Typically, the soil surface is covered with about 3 percent angular stones, 15 percent angular cobbles, and 50 percent angular gravel. The surface layer is pale brown stony sandy loam about 8 inches thick. It is commonly a fragile layer that contains vesicular pores. The next layer to a depth of 60 inches or more is pale brown very cobbly fine sandy loam. The soil between depths of 10 and 40 inches contains about 50 percent rock fragments consisting of about 3 percent angular stones, 20 percent angular cobbles, and 25 percent angular gravel. In some areas, the surface layer is very cobbly sandy loam.

Properties:
Permeability of the Millner very gravelly soil is moderately rapid (2-6 in/hr). The available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile and is mildly to moderately alkaline (pH 7.4-8.0). The organic carbon content is 0.15 to 0.3 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur on compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty is disturbed when dry.

Permeability of the Millner stony soil is moderately rapid (2-6 in/hr). The available water capacity is low (2.5-5.0 in). Effective rooting is 60 inches or more. The soil is calcareous throughout the profile and is mildly to moderately alkaline (pH 7.4-8.0). The organic carbon content is 0.15 to 0.3 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur on compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing an wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (Stipa speciosa)	25%
spiny hopsage (Grayia spinosa)	20%
Nevada ephedra (Ephedra nevadensis)	15%
Fremont dalea (Dalea fremontii)	5%
common winterfat (Eurotia lanata)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
annual forbs	5%
perennial forbs	5%
shadscale (Atriplex confertifolia)	3%
longspine horsebrush (Tetradymia axillaris)	3%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	3%
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 15 to 25 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and many rock fragments. This unit has a moderate to severe limitation for fencing due to the many small rock fragments and some large rock fragments. Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Plate 23. Typical landscape of unit 139 looking southwest across the Volcanic Tablelands toward the Sierra Nevada (Wheeler Crest). Note the very gravelly surface pavement.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments and potential dustiness. The vesicular layer is very dusty if disturbed. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many rock fragments. Excavations may be impeded by these rock fragments. Roads should be designed to control runoff and avoid excessive rilling.

Interpretive Groups:
This mapping unit is in capability subclass VIe(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments.

Plate 24. An overhead view of the surface pavement on unit 139. Note the knife for scale.

140 - Dotard* very gravelly sandy loam, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed (calcareous), mesic Xeric Torriorthents

Setting:
This very deep, well drained soil is on alluvial fans near the White Mountains. Most of these fans are joined together to form a long bajada and are incised with shallow washes and a few steep-sided drainageways. The soil formed in gravelly alluvium derived dominantly from metasedimentary rock sources. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,400 to 6,700 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 46 to 50°F, and the mean 32° frost-free season is 130 to 145 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 50 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the surface layer is brown very gravelly sandy loam about 1 inch thick. The next layer is brown gravelly sandy loam about 2 inches thick. The next layer to a depth of 60 inches or more is very pale brown very cobbly fine sandy loam. The lower layer contains an average of about 50 percent rock fragments consisting of about 5 percent angular stones, 20 percent

angular cobbles, and 25 percent angular gravel. In some areas, the surface layer is stony sandy loam.

Inclusions:
Included in this unit are small areas of soils with less than 35 percent rock fragments, Tuttle soils, Millner soils at the lower elevations, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Dotard soil is moderately rapid (2.0-6.0 in/hr). The available water capacity is low (3.0-4.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous below a depth of 3 to 10 inches. The soil reaction is slightly acid to neutral (pH 6.4-7.3) in the surface layers, and is mildly to moderately alkaline (pH 7.4-8.0) in the lower layer. The organic carbon content is 0.4 to 0.6 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur on compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is dusty if disturbed when dry.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community of this unit is mainly:

Wyoming big sagebrush (Artemisia tridentata wyomingensis)	30%
desert needlegrass (Stipa speciosa)	30%
Nevada ephedra (Ephedra nevadensis)	10%
spiny hopsage (Grayia spinosa)	10%
perennial forbs	5%
annual forbs	5%
galleta grass (Hilaria jamesii)	5%
antelope bitterbrush (Purshia tridentata)	2%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	T
longspine horsebrush (Tetradymia axillaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is poorly suited to rangeland seeding due to the low precipitation and many rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many rock fragments.
Range site name: Stony granitic fan 6-8"p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments and potential dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many rock fragments which make excavation difficult. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability unit IVs(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the many rock fragments.

* The Dotard soil mapped in this unit is a taxadjunct of the Dotard series because it has a higher mean annual soil temperature, longer frost-free season, slightly steeper slopes, and lower elevations. These differences, however, do not greatly affect use and management.

141 - Pizona - Brantel association, 2 to 50 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, mesic Xeralfic Haplargids (Pizona)
Ashy, mesic Xeric Torripsamments (Brantel)

Setting:
This mapping unit is on mountainous uplands containing small valleys. The native vegetation is mainly pinyon pines, cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,800 to 7,600 feet. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is 44 to 50°F, and the mean 32° frost-free season is 110 to 140 days. A one to two-foot mantle of snow may cover this unit in winter for brief to extended periods. Mean annual snowfall is 40 to 80 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Pizona soil and 20 percent Brantel soil. The Pizona soil is on hillsides with slopes of 9 to 50 percent and the Brantel soil is in the small valleys with slopes of 2 to 9 percent.

Inclusions:
Included with this unit are small areas of rubbleland and rock outcrops associated with the Pizona soil, soils above 7,600 feet elevation that are similar to the Pizona and Brantel soils that have a frigid soil temperature regime, Zono soils and Cashbaugh soils in the Cowtrack Mountain area, soils similar to the Pizona soil with a deep hardpan, Pizona soils that lack an ashy overburden (near Antelope Mountain), and soils that have slopes of less than 2 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Pizona soil is deep and well drained. It formed in volcanic ash and material weathered in place from basaltic rocks. Typically, the soil surface is covered with about 23 percent angular rock fragments consisting of about 3 percent stones, 10 percent cobbles, and 10 percent gravel. The surface layer is light brownish gray stony loamy sand about 11 inches thick. The surface 2

or 3 inches has loose consistency. A one-inch mat of decomposing pine needles is present beneath the tree crowns. The next layer is pale brown cobbly sandy loam about 6 inches thick. The subsoil is light yellowish brown very cobbly sandy loam and sandy clay loam about 27 inches thick. Hard, fractured basaltic bedrock is at a depth of 44 inches in this typical profile, but can range in depth from 40 to 60 inches. The subsoil contains about 40 percent angular rock fragments consisting of about 1 percent stones, 15 percent cobbles, and 25 percent gravel. In some areas the surface layer is very stony loamy sand.

The Brantel soil is very deep and somewhat excessively drained. It formed in alluvium and eolian deposits derived dominantly from rhyolitic volcanic ash. Typically, the soil surface is covered with about 10 percent fine and medium gravel (pumice and obsidian). The surface layer is light gray loamy sand about 32 inches thick. The surface 2 or 3 inches of soil has loose consistency. The next layer to a depth of 60 inches or more is light gray loamy sand and gravelly sand. The soil contains about 10 percent gravel.

Properties:
Permeability of the Pizona soil is moderately slow (0.2-0.6 in/hr). The available water capacity is low to moderate (4.0-6.0 in). Effective rooting depth is 40 to 60 inches. Many roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.6-7.8). The organic carbon content is 0.1 to 0.3 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions due to the rapid infiltration rate of the ashy overburden. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of the ashy surface layer. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions (due to the ashy overburden).

Permeability of the Brantel soil is rapid (6.0-20 in/hr). The available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to mildly alkaline (pH 6.5-7.8). The organic carbon content is 0.2 to 0.35 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on the Pizona soil is mainly:

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	30%
singleleaf pinyon pine (*Pinus monophylla*)	25%
desert needlegrass (*Stipa speciosa*)	15%
antelope bitterbrush (*Purshia tridentata*)	5%
green Mormon tea (*Ephedra viridis*)	5%
Utah juniper (*Juniperus osteosperma*)	5%

perennial forbs		5%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)		3%
sulfur buckwheat (*Eriogonum umbellatum polyanthum*)		3%
annual forbs		2%
Indian ricegrass (*Oryzopsis hymenoides*)		T
little horsebrush (*Tetradymia glabrata*)		T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface.
Range site name: Rocky loam benches 8-12" p.z. (CA-26-41)

The potential plant community on the Brantel soil is mainly:

big sagebrush (*Artemisia tridentata*)	40%
Indian ricegrass (*Oryzopsis hymenoides*)	30%
needle and thread grass (*Stipa comata*)	10%
western needlegrass (*Stipa occidentalis*)	10%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
Nevada ephedra (*Ephedra nevadensis*)	2%
annual forbs	2%
rubber rabbitbrush (*Chrysothamnus nauseosus*)	2%
staghorn cholla (*Opuntia echinocarpa*)	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface.
Range site name: Sandy 8-10" p.z. (NV-26-20)

Rubber rabbitbrush seems to establish itself well in burned of disturbed areas. This unit is poorly suited for rangeland seeding due to the steep slopes and droughty surface layer. This unit has a moderate to severe limitation for fencing due to the many large rock fragments in the Pizona soil and the loose, sandy textures of the Brantel soil.

Wood Products:
This unit is poorly suited to the production of pinyon-juniper firewood. The site index for the Pizona soil ranges from 20 to 30. It can produce 3 to 5 cords per acre in a stand of trees that averages 5 inches in diameter at a height of 1 foot.

Recreational Development:
If this unit is used for recreational uses, the main limitations are steep slopes, many surface stones in the Pizona soil, and the sandy surface layer in the Brantel soil. The Brantel soil has low susceptibility to surface scarring by off-road vehicles, but 4-wheel drive is necessary. This unit is a source of pinyon nuts.

Engineering Limitations:
If the Pizona soil is used for building sites, the main limitations are steep slopes and many stones and cobbles. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Effuent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. Roads should be designed to control surface runoff.

If the Brantel soil is used for building sites, the main limitation is the sandy texture. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Dirt roads on this soil usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
The Pizona soil is in capability subclass VIe(26), nonirrigated. The Brantel soil is in capability unit IVe-1(26), nonirrigated. This mapping unit is very poorly suited for irrigated agriculture due to the many rock fragments and steep slopes of the Pizona soil, sandy textures of the Brantel soil, and the short growing season.

142 - Avalmount - Rock outcrop complex, 5 to 30 percent slopes

Taxonomic Class:
Cindery, mesic Xerollic Camborthids

Setting:
This mapping unit is on recent lava flows in Owens Valley. The soils formed in material weathered in place from basaltic lava, with some eolian material from the surrounding alluvial soils. Dark lava rock outcrops dot the landscape. Slopes are gently rolling to hilly. The vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 6,000 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is about 52°F, and the mean 32° frost-free season is about 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 20 to 40 inches.

Percentages:
This unit is 65 percent Avalmount soils and 15 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included with this unit are small areas of stony Avalmount soils, Tuttle soils, Rovana soils, Taboose soils at the lower elevations, and soils that have slopes of less than 5 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Avalmount soil is very deep and well drained. Typically, the soil surface is covered with about 50 percent rock fragments (cinders) consisting of about 2 percent stones, 15 percent cobbles, and 35 percent gravel. The surface layer is pale brown very gravelly fine sandy loam about 10 inches thick. The next layer is dark yellowish brown very cobbly loam about 20 inches thick. The next layer is yellowish brown extremely stony very fine sandy loam to a depth of 60 inches or more. The soil below the surface layer contains an average of about 55 percent rock fragments (cinders)

consisting of about 10 percent stones, 20 percent cobbles, and 25 percent gravel. The rock fragments are jagged, low-density cinder fragments which interlock with each other to some extent. Rock fragment content usually increases with depth. In some areas the surface layer is very cobbly fine sandy loam.

Rock outcrops cover 1 to 30 percent of the surface area, but the average coverage is about 15 percent. They project 2 to 6 feet above the surface.

Properties:
Permeability of the Avalmount soil is moderate (0.6-2.0 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral (pH 6.6-7.3). The organic carbon content is about 0.6 percent. Runoff is slow. The water erosion condition class is stable under native conditions and slight under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. This soil tends to be very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (Artemisia tridentata)	35%
desert needlegrass (Stipa speciosa)	25%
Nevada ephedra (Ephedra nevadensis)	10%
California buckwheat (Eriogonum fasiculatum)	5%
annual forbs	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
perennial forbs	3%
bottlebrush squirreltail (Sitanion hystrix)	2%
spiny hopsage (Grayia spinosa)	2%
Fremont dalea (Dalea fremontii)	2%
desert peach (Prunus andersonii)	1%
Dorrs sage (Salvia dorrii)	1%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	T

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is poorly suited for rangeland seeding due to the low precipitation, many rock fragments, and many rock outcrops. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many rock fragments and rock outcrops. Range site name: Stony granitic fan 6-8" p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments and rock outcrops, some steep slopes, and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many

rock fragments and rock outcrops. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments and rock outcrops.

143 - Playa

Taxonomic Class:
none

Setting:
This mapping unit is on undrained flats in closed basins. Slopes are less than 1 percent. It does not support vegetation because of the excessive amounts of salts and sodium that are present. Playa areas occur on dry Owens Lake and around receding Mono Lake. Areas of playa have appeared in recent years around Paoha and Negit Islands wthin Mono Lake. Elevation is 3,600 to 6,500 feet. The mean annual precipitation is 4 to 12 inches, the mean annual air temperature is 47 to 59°F, and the mean 32° frost-free season is 125 to 225 days. Mean annual snowfall is 0 to 60 inches.

Typical Profile:
The sediments in playa areas typically are stratified sand, loamy sand, sandy loam, and silt loam. A thin, white crust of sodium carbonates and chlorides is on the surface from May through October or November. Depth to the water table is 12 to 48 inches.

Inclusions:
Included in this unit are small areas of Aquents, Aquic Torriorthents, and some low sand dunes. Also included are small areas of ashy Xeric Torriorthents, Durorthids, and tufa outcrops where this unit occurs around Mono Lake. Included areas make up about 10 percent of the total acreage.

Properties:
Permeability of the playa sediments is rapid to moderately slow (0.2-20 in/hr) above the water table. Available water capacity is very low (less than 2.5 in). The electrical conductivity of the saturation extract is estimated at more than 16 mmhos/cm. Runoff is ponded and the hazard of water erosion is very low. The water erosion condition class is estimated as stable. The hazard of soil blowing is high. Strong winds in spring, summer, and fall can pick up large quantities of saline dust and deposit it on the surrounding landscape more than 20 miles away. Air quality is severely impacted around Owens Lake and Mono Lake during these alkali dust storms.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

inland saltgrass (*Distichlis stricta*)
black greasewood (*Sarcobatus vermiculatus*)

Russian thistle (*Salsola* sp.)
Mojave seablite (*Sueda torreyana*)

Vegetation will probably not become established in areas where the water table remains above a depth of 4 feet. Vegetation will establish itself best in areas where the water table is below 4 feet and where the mean annual precipitation is more than 8 inches (in the Benton-Mono Lake areas). This unit is very poorly suited to rangeland seeding due to the high water table and high salt content. This unit has a moderate limitation for fencing due to wetness and excess salt.

Recreational Development:
This unit is limited by the high water table, high content of salt and sodium, and lack of vegetation. Foot travel is easy until the point is reached where the surface crust breaks. The high surface reflectance of playa areas may necessitate the use of visual protective measures on sunny days.

Engineering Limitations:
Playa areas have severe limitations for sanitary facilities, structures, roads, excavations, and reservoirs due to the high water table, poor drainage, and high content of salts and sodium.

Interpretive Groups:
This mapping unit is in capability unit VIII. This unit is very poorly suited for agriculture due to the high water table, poor drainage, and high content of salts and sodium.

144 - Rock outcrop, 50 to 150 percent slopes

Taxonomic Class:
none

Setting:
This mapping unit consists of exposures of granitic, metavolcanic, metasedimentary, or limestone rock. Slopes are 50 to 150 percent. Included in this unit are small areas of soils that occur in isolated pockets. Any vegetation that is present grows in these pockets. Runoff is very rapid. This unit is used for wildlife habitat and as a visual resource. It is limited in its uses by very steep slopes and limited accessibility. These areas show little or no potential for recreational technical rock climbing, due to excessive fractures or weathered, crumbling rock surfaces. Rock outcrop areas are highly variable as sources of commercial minerals or quarry rock. Each potential area should be examined on-site for suitability. This mapping unit is in capability class VIII.

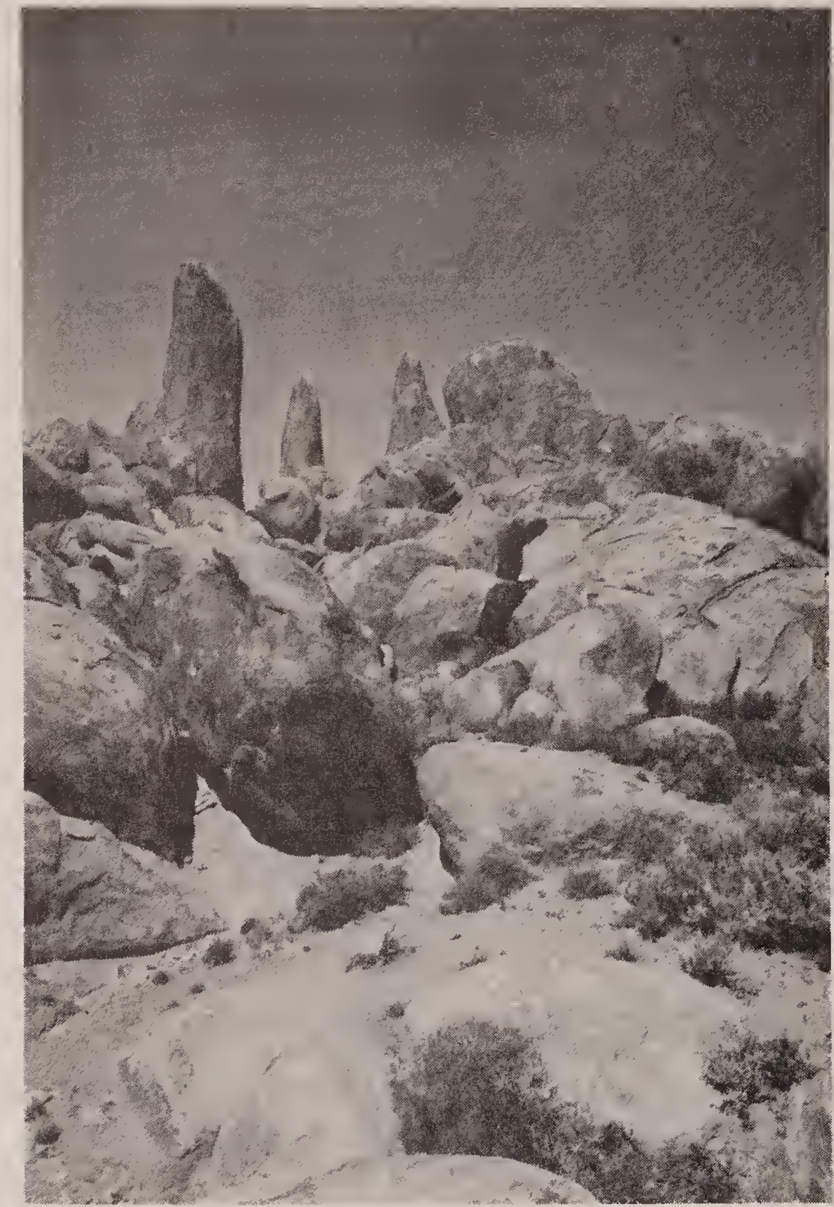


Plate 25. Many western movies have used the scenic rock outcrops in the Alabama Hills near Lone Pine as a backdrop.

145 - Rovana gravelly loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Sandy, mixed, mesic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained, sandy soil is on alluvial fans at the base of the Sierra Nevada mountains. It formed in alluvium derived dominantly from granitic rock sources. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 6,200 feet. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature

is 50 to 53°F, and the mean 32° frost-free season is 130 to 160 days. A six inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 60 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 30 percent fine granitic gravel. The surface layer is brown gravelly loamy coarse sand about 12 inches thick. The surface 2 or 3 inches has loose consistency. The next layer to a a depth of 60 inches or more is pale brown gravelly coarse sand and loamy coarse sand. The soil contains an average of about 25 percent fine granitic gravel and a trace of cobbles and stones. Some very gravelly lenses are in the lower layer above a depth of 40 inches. Some of the Rovana soils have very cobbly or very stony textures below a depth of 40 inches. In some areas the surface layer is loamy coarse sand.

Inclusions:
Included in this unit are small areas of soils similar to the Rovana soils but lacking the very gravelly lenses in the lower layer (Xeric Torripsamments), Tuttle soils, Washoe soils, Washoe Variant soils, moist soils in stream drainageways, and soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Rovana soil is rapid (6-20 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.35 to 0.60 percent. Runoff is very slow. The water erosion condition class is estimated as low under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for wildlife habitat, grazing, and recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	25%
desert needlegrass (*Stipa speciosa*)	25%
desert bitterbrush (*Purshia glandulosa*)	20%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
spiny hopsage (*Grayia spinosa*)	3%
perennial forbs	3%
green Mormon tea (*Ephedra viridis*)	2%
Nevada ephedra (*Ephedra nevadensis*)	2%
annual forbs	2%
Nevada bluegrass (*Poa nevadensis*)	2%
California buckwheat (*Eriogonum fasciculatum*)	2%
bottlebrush squirreltail (*Sitanion hystrix*)	2%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	T

The annual production of air-dry vegetation ranges from 500 to 800 pounds per acre. Vegetation covers 30 to 40 percent of the soil surface. This unit is poorly suited to rangeland seeding due to the sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate limitation for fencing due to the sandy textures.
Range site name: Stony granitic fan 8-10" p.z. (CA-29-33)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the sandy texture. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy texture. Cutbanks are not stable and are subject to slumping. Roads should be designed to control surface runoff and avoid excessive rilling.

Interpretive Groups:
This mapping unit is in capability unit IVe-1(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the sandy textures, slope, and short growing season.

146 - Rovana loamy sand, 0 to 5 percent slopes

Taxonomic Class:
Sandy, mixed, mesic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained, sandy soil is on alluvial fans and valley floors in Benton Valley. It formed in alluvium derived from granitic rock sources and rhyolitic volcanic ash. The topography is nearly level to gently sloping. The native vegetation is cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,400 to 5,900 feet. The mean annual precipitation is 8 to 9 inches, the mean annual air temperature is 49 to 51°F, and the mean 32° frost-free season is 130 to 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 30 inches. Some summer thundershowers occur, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the surface layer is light gray loamy sand about 10 inches thick. The surface 2 or 3 inches has loose consistency. The next layer to a depth of 60 inches or more is pale brown loamy coarse sand and gravelly loamy coarse sand. Some very gravelly lenses are in this layer above a depth of 40 inches. The soil contains an average of about 15 percent gravel, with a trace of cobbles. It also contains about 45 percent rhyolitic volcanic ash by weight. In some areas, the surface layer is sand.

Inclusions:
Included in this unit are small areas of soils similar to the Rovana soil but lacking the very gravelly lenses in the lower layer (Xeric Torripsamments),

soils that have a weak hardpan below a depth of 15 inches, Tuttle soils, moist soils in stream drainageways, and soils that have slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Rovana soil is rapid (6-20 in/hr). The available water capacity is low to moderate (3.5-5.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). Runoff is very slow. The soil contains about 40 percent rhyolitic volcanic ash by weight. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of wind erosion is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	25%
desert needlegrass (*Stipa speciosa*)	25%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	5%
Nevada ephedra (*Ephedra nevadensis*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
blackbrush (*Coleogyne ramosissima*)	5%
spiny hopsage (*Grayia spinosa*)	5%
California buckwheat (*Eriogonum fasciculatum*)	5%
perennial forbs	3%
annual forbs	2%
Nevada bluegrass (*Poa nevadensis*)	2%
bottlebrush squirreltail (*Sitanion hystrix*)	2%
desert bitterbrush (*Purshia glandulosa*)	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is poorly suited for rangeland seeding due to the low precipitation and sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the sandy textures.
Range site name: Sandy 8-10" p.z. (NV-26-20)

Recreational Development:
If this unit is used for recreational development, the main limitation is the loose, sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy texture. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting

the building site before construction begins. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability IVs-4(26), irrigated and IVe-1(26), nonirrigated. This unit is moderately well suited for irrigated agriculture. It is limited by low to moderate available water capacity, rapid permeability, the short growing season, and the hazard of soil blowing.

147 - Sawavu - Brantel complex, 2 to 9 percent slopes

Taxonomic Class:
Ashy, mesic Haploxerollic Durorthids (Sawavu)
Ashy, mesic Xeric Torripsamments (Brantel)

Setting:
This mapping unit is on alluvial fan terraces in the Benton unit. Slopes are undulating to gently rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,400 to 7,300 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 46 to 50°F, and the mean 32° frost-free season is 125 to 150 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 35 to 65 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Sawavu soil and 30 percent Brantel soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the Brantel soil that have cobbly lower layers and pinyon pine vegetation (Xeric Torriorthents) on the higher parts of some alluvial fans, soils similar to the Sawavu soil that have a thin hardpan at depths of 40 to 60 inches, Buscones soils, Wellington soils, soils near the floor of Adobe Valley that have slight saline-sodic conditions, and soils with slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Sawavu soil is moderately deep and somewhat excessively drained. It formed in rhyolitic volcanic ash derived from airfall and alluvial ash deposits. Typically, the surface layer is light brownish gray gravelly loamy sand about ½ inch thick. The next layer is light gray loamy sand about 24 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is a discontinuous, silica-cemented hardpan about 26 inches thick. The next layer to a depth of 60 inches or more is light gray loamy sand. In some areas, the soil below the surface layer is gravelly loamy sand. The soil contains 5 to 25 percent pumice gravel. The hardpan occurs at a depth of 24

inches in this typical profile, but can range from 20 to 40 inches deep.

The Brantel soil is very deep and somewhat excessively drained. It formed in rhyolitic volcanic ash derived from airfall and alluvial ash deposits. Typically, the surface layer is light gray gravelly loamy sand about ½ inch thick. The next layer is light gray loamy sand about 32 inches thick. The surface 2 or 3 inches has loose consistency. The next layer to a depth of 60 inches or more is light gray loamy sand and gravelly sand. The soil contains 5 to 25 percent pumice gravel.

Properties:
Permeability of the Sawavu soil is rapid (6-20 in/hr). The available water capacity is low to moderate (2.5-6.0 in). Effective rooting depth is 20 to 40 inches. Some roots penetrate the hardpan through gaps or cracks. The soil is noncalcareous in most areas, but the hardpan is slightly calcareous in some areas. The soil is neutral to mildly alkaline (pH 6.6-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Brantel soil is rapid (6-20 in/hr). The available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil in noncalcareous and is slightly acid to mildly alkaline (pH 6.5-7.5). The organic carbon content is 0.2 to 0.35 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. Hoewever, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Wyoming big sagebrush (Artemisia tridentata wyomingensis)	40%
Indian ricegrass (Oryzopsis hymenoides)	30%
needle and thread grass (Stipa comata)	5%
bottlebrush squirreltail (Sitanion hystrix)	5%
annual forbs	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	2%
Nevada ephedra (Ephedra nevadensis)	2%
basin big sagebrush (Artemisia tridentata tridentata)	2%
spiny hopsage (Grayia spinosa)	T
rubber rabbitbrush (Chrysothamnus nauseosus)	T
longspine horsebrush (Tetradymia axillaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is

poorly suited to rangeland seeding due to the low precipitation and droughty surface layers. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Sandy 8-10" p.z. (NV-26-20)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the loose, sandy surface layers and rare hazard of flash flooding. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Plate 26. Typical landscape of unit 147 in foreground and middle ground. Looking east across Benton Valley toward the northern White Mountains.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the hardpan of the Sawavu soil. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Cutbanks are not stable and are subject to slumping. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability of these soils, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability unit IVs-4(26), irrigated, and IVe-1(26), nonirrigated. This unit is moderately well suited for irrigated agriculture. It is limited by rapid permeability, the hardpan of the Sawavu soil, droughty surface layers, and the hazard of soil blowing. Ripping and shattering the hardpan increases the effective rooting depth.

148 - Sherwin very cobbly loamy fine sand, 5 to 15 percent slopes

Taxonomic Class:
Loamy, mixed, nonacid, mesic Lithic Xeric Torriorthents

Setting:
This shallow or very shallow, well drained soil is on the volcanic tablelands, north of Bishop. The topography is gently rolling to rolling. It formed in material weathered in place from hard rhyolitic volcanic tuff, with some eolian material from surrounding soils. The landscape is broken by some steep-sided drainageways and fault escarpments that are 10 to 50 feet high. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,300 to 7,300 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 45 to 53°F, and the mean 32° frost-free season is 125 to 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the soil surface is covered with about 40 percent angular rock fragments consisting of about 1 percent stones, 20 percent cobbles, and 20 percent gravel (all tuff fragments). The surface layer is light gray very cobbly loamy fine sand about 3 inches thick. The next layer is light gray sandy loam or gravelly sandy loam about 4 inches thick. This layer is usually a fragile layer with vesicular pores. Hard rhyolitic tuff bedrock is at a depth of 7 inches in this typical profile, but can range from 4 to 14 inches deep. Most of the rock fragments are in the surface layer. The lower layer contains about 10 percent rock fragments consisting of about 1 percent stones, 5 percent cobbles, and 5 percent gravel (all tuff fragments).

Inclusions:
Included in this unit are small areas of soils similar to the Sherwin soil but with cobbly loamy sand textures throughout the profile, soils that contain more than 35 percent rock fragments, soils that have sandy clay loam subsoils, rock outcrops and rubbleland on the fault scarps, drainageway sideslopes, and fumarolic mounds, soils similar to the Sherwin soil that are more than 14 inches deep, Buscones soils, Brantel and Sawavu soils in drainageways, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Sherwin soil is moderately rapid (2-6 in/hr). The available water capacity is very low (0.3-1.5 in). Effective rooting depth is 4 to 14 inches. The soil is noncalcareous and is neutral (pH 6.6-7.3). The organic matter content is 0.3 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. The vesicular layer is very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (Artemisia tridentata)	25%
desert needlegrass (Stipa speciosa)	20%
spiny hopsage (Grayia spinosa)	10%
desert bitterbrush (Purshia glandulosa)	5%
Nevada ephedra (Ephedra nevadensis)	5%
Fremont dalea (Dalea fremontii)	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	5%
spiny menodora (Menodora spinescens)	5%
perennial forbs	2%
annual forbs	2%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	2%
blackbrush (Coleogyne ramosissima)	2%
singleleaf pinyon pine (Pinus monophylla)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers about 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation, shallow soil depth, and many rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the shallow bedrock.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitatiions are shallow soil depth, dustiness, and many rock fragments in the surface layer. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the shallow soil depth. Cuts needed to provide essentially level building sites can expose the hard tuff bedrock. The shallow bedrock increases the possibility of failure of conventional septic tank systems. Use of sandy backfill, long absorption lines, and trenches excavated into the bedrock helps to compensate for the shallow soil depth. Even so, effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit unit is in capability class VIII. This unit is very poorly for irrigated agriculture due to the shallow soil depth and many rock fragments.

149 - Taboose - Rock outcrop complex, 5 to 30 percent slopes

Taxonomic Class:
Cindery, thermic Xeric Torriorthents

Setting:
This mapping unit is on recent lava flows on the west side of Owens Valley.

The soils formed in material weathered in place from basaltic lava, with some eolian material from the surrounding alluvial soils. Slopes are gently rolling to hilly. Dark lava rock outcrops dot the landscape. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 3,800 to 5,200 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 54 to 56°F, and the mean 32° frost-free season is 175 to 200 days. Mean annual snowfall is about 15 inches.

Percentages:
This unit is 65 percent Taboose soils and 15 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included with this unit are small areas of stony Taboose soils, Thibau soils in drainageways, Pajuela soils, soils similar to the Taboose soil but with 20 to 40 inches of sandy overburden (mainly east of Red Mountain), Avalmount soils at the higher elevations, and soils that have slopes of less than 5 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Taboose soil is very deep and well drained. Typically, the soil surface is covered with about 50 percent rock fragments consisting of about 1 percent stones, 15 percent cobbles, and 35 percent gravel (all cinder fragments). The surface layer is brown very gravelly loamy fine sand about 5 inches thick. The next layer is pale brown gravelly fine sandy loam about 20 inches thick. The next layer to a depth of 60 inches or more is yellowish brown extremely stony loamy fine sand. This layer contains about 70 percent rock fragments consisting of about 20 percent stones, 10 percent cobbles, and 40 percent gravel (cinder fragments). The rock fragments are jagged, low-density cinders which interlock somewhat. In some areas the surface layer is very cobbly loamy fine sand.

The rock outcrops cover 1 to 30 percent of the surface area, but the total average coverage is about 15 percent. They project 2 to 6 feet above the soil surface.

Properties:
Permeability of the Taboose soil is moderately rapid (2-6 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.3 to 0.5 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. However, this soil tends to be very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing and wildlife habitat.

Plate 27. Typical landscape of unit 149 in foreground. Unit 166 on hill in right middle ground. Unit 158 on cinder cone in left background. Looking south down Owens Valley towards the Sierra Nevada.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Nevada ephedra (Ephedra nevadensis)	20%
desert needlegrass (Stipa speciosa)	20%
spiny hopsage (Grayia spinosa)	10%
Fremont dalea (Dalea fremontii)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
California buckwheat (Eriogonum fasciculatum)	5%
Cooper goldenbush (Haplopappus cooperi)	5%
longspine horsebrush (Tetradymia axillaris)	2%
common winterfat (Eurotia lanata)	2%
annual forbs	2%
cheatgrass (Bromus tectorum)	2%
red brome (Bromus rubens)	2%
needleleaf rabbitbrush (Chrysothamnus teretifolius)	1%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the low precipitation, many rock fragments, and many rock outcrops. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many rock fragments and rock outcrops.
Range site name: Cindery loamy sand 4-8" p.z. (CA-29-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments, rock outcrops, some steep slopes, and dustiness. The soil has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many rock fragments and rock outcrops. Excavations may be impeded by the many rock fragments. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments and rock outcrops.

150 - Taboose* - Rock outcrop complex, 5 to 15 percent slopes

Taxonomic Class:
Cindery, thermic Typic Torriorthents

Setting:
This mapping unit is on recent lava flows on the east side of Owens Valley. The soils formed in material weathered in place from basaltic lava, with some eolian material from the surrounding alluvial soils. Slopes are gently rolling to hilly. Dark lava rock outcrops dot the landscape. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevations are 3,800 to 4,800 feet. The mean annual precipitation is about 5 inches, the mean annual air temperature is about 56°F, and the mean 32° frost-free season is about 200 days. Mean annual snowfall is about 5 inches.

Percentages:
This unit is 65 percent Taboose soils and 15 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included with this unit are small areas of stony Taboose soils, Arizo soils, Yermo soils, Cajon soils in drainageways, Taboose soils similar to those in mapping unit 149 at the higher elevations, and soils with slopes of less than 5 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Taboose soil is very deep and well drained. Typically, the soil surface is covered with about 40 percent rock fragments consisting of about 1 percent stones, 10 percent cobbles, and 30 percent gravel (all cinder fragments). The surface layer is pale brown very gravelly fine sandy loam about 5 inches thick. The next layer to a depth of 60 inches or more is pale brown extremely stony fine sandy loam. This layer contains about 75 percent rock fragments consisting of about 15 percent stones, 30 percent cobbles, and 30 percent gravel (all cinder fragments). The rock fragments are jagged, low-density cinders which interlock with each other to some extent. In some

areas the surface layer is very cobbly fine sandy loam.

The rock outcrops cover 1 to 30 percent of the surface area, but the total average coverage is about 15 percent. They project 2 to 6 feet above the soil surface.

Properties:
Permeability of this Taboose soil is moderately rapid (2-6 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately alkaline (pH 7.9-8.4). The organic carbon content is 0.1 to 0.3 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. However, this soil tends to be very dusty if it is disturbed when dry.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (*Atriplex confertifolia*)	35%
Fremont dalea (*Dalea fremontii*)	20%
desert needlegrass (*Stipa speciosa*)	15%
Nevada ephedra (*Ephedra nevadensis*)	5%
spiny hopsage (*Grayia spinosa*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
perennial forbs	2%
annual forbs	2%
longspine horsebrush (*Tetradymia axillaris*)	2%
California buckwheat (*Eriogonum fasciculatum*)	2%
red brome (*Bromus rubens*)	2%
common winterfat (*Eurotia lanata*)	2%

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the many rock fragments, low precipitation, and frequent rock outcrops. This unit has a moderate to severe limitation for fencing due to the many rock fragments and rock outcrops.
Range site name: Cindery loamy sand 4-8" p.z. (CA-29-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments, rock outcrops, and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many rock fragments and rock outcrops. Excavations may be impeded by the many rock fragments. Roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments and rock outcrops.

* The Taboose soil in this unit is a taxadjunct to the Taboose series because it receives less precipitation, is calcareous, and has a slightly different plant community. These differences, however, do not greatly affect use and management.

151 - Thibau loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Sandy, mixed, thermic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans on the west side of the Owens Valley. These fans are joined together into a long bajada and are incised with shallow washes and a few steep-sided drainageways. The soil formed in recent alluvium derived dominantly from granitic rock sources. The topography is moderately to strongly sloping. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,000 to 5,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 54 to 58°F, and the mean 32° frost-free season is 150 to 200 days. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the surface layer is pale brown loamy coarse sand about 11 inches thick. The next layer to a depth of 60 inches or more is light yellowish brown loamy coarse sand and gravelly loamy coarse sand. Some very gravelly lenses are in the lower layer above a depth of 40 inches. The soil contains an average of about 10 percent gravel and a trace of cobbles and stones. In some areas the surface layer is gravelly loamy coarse sand.

Inclusions:
Included in this unit are small areas of soils similar to the Thibau soil but lacking the very gravelly lenses (Xeric Torripsamments), Pajuela soils, Lubkin soils, Tinemaha soils, moist soils near stream drainageways with big sagebrush vegetation, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Thibau soil is rapid (6-20 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard

of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and as a source of road construction material.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (*Stipa speciosa*)	20%
Nevada ephedra (*Ephedra nevadensis*)	10%
blackbrush (*Coleogyne ramosissima*)	10%
spiny hopsage (*Grayia spinosa*)	10%
California buckwheat (*Eriogonum fasciculatum*)	10%
Fremont dalea (*Dalea fremontia*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
bud sagebrush (*Artemisia spinescens*)	5%
Cooper goldenbush (*Haplopappus cooperi*)	5%
common winterfat (*Eurotia lanata*)	3%
longspine horsebrush (*Tetradymia axillaris*)	3%
annual forbs	3%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	2%
white burrobush (*Hymenoclea salsola*)	2%
shadscale (*Atriplex confertifolia*)	1%
Anderson wolfberry (*Lycium andersonii*)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers about 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the sandy textures.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the sandy texture. This unit has low susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the sandy texture. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the building site before construction begins. Roads should be designed to control surface runoff and avoid excess rilling.

Interpretive Groups:
This mapping unit is in capability sunit IVs-4(29), irrigated, and subclass VIe(29), nonirrigated. This soil is moderately well suited for irrigated agriculture, but it is limited by small and irregular acreages, excessive slopes, sandy textures, and the hazard of soil blowing.

152 - Thibau gravelly loamy coarse sand, 15 to 30 percent slopes

Taxonomic Class:
Sandy, mixed, thermic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans and slope wash areas on the west side of Owens Valley. These fans are joined together into a bajada and are incised with a few shallow washes and steep-sided drainageways. The soil formed in alluvium from granitic rock sources. Slopes are vertically concave and moderately steep. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs forbs. Elevation is 4,400 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 54 to 57°F, and the mean 32° frost-free season is 150 to 200 days. Mean annual snowfall is about 15 inches.

Typical Profile:
Typically, the soil surface is covered with about 30 percent fine granitic gravel. The surface layer is light yellowish brown gravelly loamy coarse sand about 10 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light yellowish brown loamy coarse sand about 17 inches thick. The next layer is light yellowish brown gravelly loamy coarse sand about 17 inches thick. The next layer to a depth of 60 inches or more is light yellowish brown very gravelly loamy coarse sand. Some very gravelly lenses are in the lower layers above a depth of 40 inches. The soil contains an average of about 20 percent gravel and a trace of cobbles. The rock fragment content is usually greater below a depth of 40 inches. In some areas the surface layer is loamy coarse sand.

Inclusions:
Included in this unit are small areas of soils similar to the Thibau soil but lacking the very gravelly lenses (Xeric Torripsamments), Pajuela soils where many cobbles and stones are present, Lubkin soils, Tuttle and Rovana soils at the higher elevations, and soils with slopes of less than 15 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Thibau soil is rapid (6-20 in/hr). The available water capacity is low (3.0-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to rill erosion. The soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for wildlife habitat and grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (*Stipa speciosa*)	20%
Nevada ephedra (*Ephedra nevadensis*)	10%
blackbrush (*Coleogyne ramosissima*)	10%
spiny hopsage (*Grayia spinosa*)	10%
California buckwheat (*Eriogonum fasciculatum*)	10%
longspine horsebrush (*Tetradymia axillaris*)	5%
Fremont dalea (*Dalea fremontii*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
bud sagebrush (*Artemisia spinescens*)	5%
Cooper goldenbush (*Haplopappus cooperi*)	5%
annual forbs	3%
common winterfat (*Eurotia lanata*)	2%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	2%
white burrobush (*Hymenoclea salsola*)	2%
shadscale (*Atriplex confertifolia*)	1%
Anderson wolfberry (*Lycium andersonii*)	T

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetatiuon covers 20 to 30 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and sandy textures. Rubber rabbitbrush seems to extablish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the sandy textures.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and steep slopes in some areas. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and steep slopes in some areas. Cutbanks are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Proper design of road drainage sustems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Interpretive Groups:
This mapping unit is in capability subclass VIe(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the slope, topography, and sandy textures.

153 - Tinemaha very bouldery loamy coarse sand, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, thermic Xeralfic Haplargids

Setting:
This very deep, well drained soil is on alluvial fans and fan terraces on the west side of Owens Valley. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans and fan terraces, which are joined together to form long bajadas; are incised with shallow washes and a few steep-sided drainageways. Stringers of stones and boulders radiate down the fans from the mouth of canyons. A few of the boulders are more than 6 feet in dismeter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation ranges from 4,000 to 5,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 54 to 57°F, and the mean 32° frost-free season is 150 to 200 days. A 1 to 3-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the surface is covered with about 20 percent boulders and stones, 5 percent cobbles, and 15 percent fine gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is pale brown very bouldery loamy coarse sand about 9 inches thick. The subsoil is yellowish brown very stony sandy loam or sandy clay loam about 18 inches thick. The substratum to a depth of 60 inches or more is pale brown very stony loamy coarse sand. The subsoil and substratum contain about 50 percent rock fragments consisting of about 30 percent boulders and stones, 10 percent cobbles, and 10 percent gravel.

Inclusions:
Included in this unit are small areas of Tinemaha soils with bouldery or extremely bouldery surface layers, Lubkin soils, Washoe and Washoe Variant soils at the higher elevations, Pajuela soils, Thibau soils, rubbleland, moist soils along stream drainages, and soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Tinemaha soil is moderately rapid to moderately slow (0.2 -6.0 in/hr). Available water capacity is low (2.5-5.0 in). The soil is noncalcareous. The effective rooting depth is 60 inches or more. The soil reaction is neutral to mildly alkaline (pH 6.8-7.5). The ogranic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. The hazard of soil blowing is less where the surface is covered with more rock fragments.

Use:
This unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community is mainly:

desert needlegrass (*Stipa speciosa*)	25%
blackbrush (*Coleogyne ramossissima*)	20%
Nevada ephedra (*Ephedra nevadensis*)	10%
spiny hopsage (*Grayia spinosa*)	10%
California buckwheat (*Eriogonum fasciculatum*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
common winterfat (*Eurotia lanata*)	5%
longspine horsebrush (*Tetradymia axillaris*)	2%
white burrobush (*Hymenoclea salsola*)	2%
Cooper goldenbush (*Haplopappus cooperi*)	2%
perennial forbs	2%
annual forbs	2%
bud sagebrush (*Artemisia spinescens*)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the many rock fragments and low precipitation. This unit has a severe limitation for fencing due to the many large rock fragments.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and slow subsoil permeability in some areas. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many large rock fragments and slow subsoil permeability in some areas. The many large rock fragments make excavation difficult. Significant rilling by water may occur on dirt roads that run up and down the slope. If the Tinemaha soil is used for septic tank absorption fields, absorption lines should be placed below the slowly permeable layer (below 48 inches).

Interpretive Groups:
This mapping unit is in capability subclass VIIs(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the many large rock fragments.

154 - Tinemaha - Lubkin complex, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, thermic Xeralfic Haplargids (Tinemaha)
Coarse-loamy, mixed, thermic Xeralfic Haplargids (Lubkin)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces on the west side of Owens Valley. Most of these fans and fan terraces, which are

joined together to form a long bajada, are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,000 to 5,400 feet. The mean annual precipitation is 6 to 8 inches. The mean annual air temperature is 54 to 57°F. The mean 32° frost-free season is 150 to 200 days. A 1 to 3-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is about 15 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 40 percent Tinemaha soil and 25 percent Lubkin soil. The Tinemaha soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soil similar to the Lubkin soil with sandy clay loam subsoils (fine-loamy, mixed, thermic Xeralfic Haplargids), very bouldery Tinemaha soils, Pajuela soils, Thibau soils, Washoe, Washoe Variant, and Tuttle soils at the higher elevations, moist soils in stream drainageways, rubbleland, and soils with slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Tinemaha soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 3 percent boulders and stones, 3 percent cobbles, and 20 percent gravel. The surface layer is pale brown bouldery loamy coarse sand about 9 inches thick. Some areas have a thin, fragile layer with vesicular pores and loamy textures about 3 inches below the soil surface. The subsoil is yellowish brown very cobbly or very stony sandy clay loam or sandy loam about 18 inches thick. The substratum to a depth of 60 inches or more is pale brown very stony loamy coarse sand. The subsoil and substratum contain about 50 percent rock fragments consisting of about 10 percent boulders and stones, 30 percent cobbles, and 10 percent gravel.

The Lubkin soil is very deep and well drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 1 percent boulders, stones, and cobbles, and 10 percent gravel. The surface layer is light yellowish brown loamy coarse sand about 4 inches thick. Some areas have a thin, fragile layer with vesicular pores and loamy textures about 3 inches below the soil surface. The subsoil is light yellowish brown gravelly sandy loam about 32 inches thick. It contains about 20 percent gravel. The substratum to a depth of 60 inches or more is light yellowish brown gravelly or cobbly loamy coarse sand. It contains about 25 percent rock fragments consisting of about 10 percent cobbles and 15 percent gravel. In some areas the surface layer contains up to 3 percent boulders and stones, and the subsoil and substratum contain up to 10 percent boulders and stones.

Properties:
Permeability of the Tinemaha soil is moderately rapid to moderately slow (0.2-

2.0 in/hr). The available water capacity is low (3.0-5.0 in.) Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Lubkin soil is moderately rapid (2-6 in/hr). Available water capacity is moderate (5.0-6.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (*Stipa speciosa*)	25%
blackbrush (*Colegyne ramosissima*)	20%
Nevada ephedra (*Ephedra nevadensis*)	10%
California buckwheat (*Eriogonum fasciculatum*)	10%
spiny hopsage (*Grayia spinosa*)	10%
Indian ricegrass (*Oryzopsis hymenoidies*)	5%
common winterfat (*Eurotia lanata*)	5%
longspine horsebrush (*Tetradymia axillaris*)	2%
white burrobush (*Hymenoclea salsola*)	2%
Cooper goldenbush (*Haplopappus cooperi*)	2%
bud sagebrush (*Artemisia spinescens*)	2%
perennial forbs	2%
annual forbs	2%
Anderson wolfberry (*Lycium andersonii*)	T

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and many large rock fragments. This unit has a moderate to severe limitation for fencing due to the many large rock fragments of the Tinemaha soil.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments, sandy surface layers, and slow subsoil permeability in some areas. This unit has low to moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are many large rock fragments and slow subsoil permeability in some areas. The many large rock fragments make excavation difficult. Where slopes are more than 5

percent, significant rilling by water may occur on dirt roads that run up and down the slope. Roads should be designed to control surface runoff. If this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and by placing the lines below a depth of 48 inches.

Interpretive Groups:
This mapping unit is in capability subclass VIs(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the many large rock fragments.

155 - Xeralfic Haplargids, mesic, 5 to 30 percent slopes

Taxonomic Class:
Xeralfic Haplargids

Setting:
These soils are very deep and well drained. They are on glacial moraines near the mouths of canyons at the eastern base of the Sierra Nevada. The soils formed in glacial till from predominantly granitic rock sources. The topography is undulating to hilly. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,100 feet to 7,200 feet. The mean annual precipitation is 7 to 12 inches and the mean annual air temperature is 45 to 51° F. The mean 32° frost-free season is 125 to 150 days. A 6-inch to 2-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 70 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
The soil surface is covered with 3 to 60 percent boulders and stones, 5 to 30 percent cobbles, and 20 to 40 percent gravel. Some of the boulders exceed 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The surface layer is stony, very stony, bouldery, very bouldery, extremely bouldery, or very gravelly, sandy loam or loamy coarse sand about 12 inches thick. The subsoil is very cobbly to extremely bouldery, sandy loam or sandy clay loam. The substratum to a depth of 60 inches or more is very cobbly to extremely bouldery loamy coarse sand. The subsoil contains 35 to 60 percent rock fragments consisting of 3 to 50 percent boulders and stones, 10 to 30 percent cobbles, and 15 to 30 percent gravel.

Inclusions:
Included in this unit are soils lacking a dense subsoil, soils with less than 35 percent rock fragments, rubbleland, and soils with slopes of less than 5 or more than 30 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of these soils is moderately rapid to moderately slow (0.2-6.0 in/hr). Available water capacity is low to very low (1.2-3.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.6). The organic carbon content is

0.3 to 0.5 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	25%
blackbrush (*Coleogyne ramosissima*)	20%
spiny hopsage (*Grayia spinosa*)	10%
desert bitterbrush (*Purshia glandulosa*)	10%
desert needlegrass (*Stipa speciosa*)	10%
antelope bitterbrush (*Purshia tridentata*)	5%
Nevada ephedra (*Ephedra nevadensis*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
bottlebrush squirreltail (*Sitanion hystrix*)	5%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	1%

Plate 28. Unit 155 is on the low ridge (lateral moraine) extending across the middle ground. The glacier that produced the moraine flowed out of Pine Creek Canyon at right. Unit 160 is in foreground. Looking southwest towards Mount Tom.

The annual production of air-dry vegetation ranges from 400 to 500 pounds per acre. Vegetation covers 15 to 25 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the many large rock

fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many large rock fragments.
Range site name: Stony granitic fan 8-10" p.z. (CA-29-33)
Blackbrush fan 6-8" p.z. (CA-29-31)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are many large rock fragments and some steep slopes.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many large rock fragments and some steep slopes. Excavations may be impeded by the many rock fragments. Access roads should be designed to control surface runoff and help stabilize cut slopes. Where slopes are more than 5 percent, significant rilling by water may occur on dirt roads that run up and down the slope.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited to irrigated agriculture due to the many rock fragments, steep slopes, and short growing season in some areas.

156 - Lithic Xeric Torriorthents - Buscones complex, 15 to 50 percent slopes

Taxonomic Class:
Lithic Xeric Torriorthents
Ashy, mesic Xeric Torripsamments (Buscones)

Setting:
This mapping unit is on hills in the Benton Range, north of Bishop. The topography is hilly to steep. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 5,400 to 7,600 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 45 to 50°F, and the mean 32° frost-free season is 125 to 150 days. A six-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Percentages:
This unit is 60 percent Lithic Xeric Torriorthents and 20 percent Buscones soil. The Buscones soil is usually on slopes of 15 to 30 percent below 7,400 feet elevation. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils similar to the Lithic Xeric Torriorthents but deeper than 20 inches (mostly in swales and at bases of hills), soils with sandy clay loam subsoils associated with the Lithic Xeric Torriorthents, Buscones soils with a thin hardpan layer over the soft tuff, soils similar to the Buscones soil that contain more than 35 percent rock

fragments, rock outcrops, and soils with slopes of less than 15 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Lithic Xeric Torriorthents are shallow to very shallow, and are well drained. They formed in material weathered in place from metasedimentary and granitic rock. The soil surface is covered with 20 to 70 percent angular stones, cobbles, and gravel. The surface layer is cobbly, gravelly, or very cobbly, sandy loam or loamy sand, 3 to 20 inches deep over hard, fractured bedrock. The soil as a whole contains 15 to 50 percent rock fragments consisting of angular stones, cobbles, and gravel.

The Buscones soil is moderately deep and somewhat excessively drained. It formed in rhyolitic volcanic ash weathered in place from soft volcanic tuff. Typically, the surface is covered with about 40 percent fine and medium pumice gravel. The surface layer is light gray very gravelly loamy sand about ½-inch thick. The next layer is light gray loamy sand and gravelly loamy sand about 31 inches thick. The surface 2 or 3 inches has loose consistency. The soft tuff bedrock is at a depth of about 31 inches in this typical profile, but can range from 20 to 40 inches deep. The soil below the surface layer contains about 5 to 30 percent gravel (pumice and obsidian fragments).

Properties:
Permeability of the Lithic Xeric Torriorthents is moderately rapid to rapid (2.0-20 in/hr). Available water capacity is low to very low (0.3-1.7 in). Effective rooting depth is 3 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.3 to 0.6 percent. Runoff is medium to rapid. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Buscones soil is rapid (6-20 in/hr). Available water capacity is low to very low (1.5-4.0 in). Effective rooting depth is 20 to 40 inches. The soil is noncalcareous and is neutral (pH 6.6-7.3). The organic carbon content is 0.1 to 0.3 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly :

big sagebrush (Artemisia tridentata)	40%
desert needlegrass (Stipa speciosa)	15%
Douglas rabbitbrush (Chrysothamnus nauseosus)	10%
desert bitterbrush (Purshia glandulosa)	10%
Nevada ephedra (Ephedra nevadensis)	5%

perennial forbs	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
annual forbs	3%
spiny hopsage (*Grayia spinosa*)	2%
longspine horsebrush (*Tetradymia axillaris*)	T

Some singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) are present at higher elevations. The annual production of air-dry vegetation ranges from 100 to 500 pounds per acre. Vegetation covers 15 to 30 percent of the soul surface. This unit is poorly to very poorly suited for rangeland seeding due to the low precipitation, some steep slopes, and many rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to some steep slopes, shallow soils, rock fragments, and sandy textures (of the Buscones soil).
Range site name: Rocky upland loam 8-12" p.z. (CA-26-42) (Lithic Xeric Torriorthents)
Sandy 8-10" p.z. (CA-26-20) (Buscones)

Wood Products
This unit is very poorly suited to the production of pinyon-juniper firewood due to the very low site index.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are some steep slopes, many shallow soils, and the sandy texture of the Buscones soil. The Lithic Xeric Torriorthents have high susceptibility to surface scarring by off-road vehicles. The Buscones soil has low susceptibility. This unit is a source of pinyon nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are some steep slopes, many shallow soils, and sandy textures of the Buscones soil. Cuts needed to provide essentially level building sites can expose hard bedrock or soft volcanic tuff. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many steep slopes, shallow soils, short growing season, and sandy textures of the Buscones soil.

157 - Torriorthents - Haplargids - Rock outcrop complex, frigid, 15 to 50 percent slopes

Taxonomic Class:
Torriorthents
Haplargids

Setting:
This mapping unit is on rocky and bouldery mountain slopes and plateaus in the Inyo Mountains, the Sierra Nevada, and near Granite Mountain. The topography

is hilly to steep. The native vegetation is mainly subalpine forest with an understory of cool desert shrubs and perennial grasses and forbs. Elevation is 8,000 to 9,600 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is 38 to 43°F, and the mean 32° frost-free season is 75 to 100 days. A one-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 60 to 90 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. The mean annual soil temperature is 43 to 47°F.

Percentages:
This unit is 40 percent Torriorthents, 20 percent Haplargids, and 20 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of soils with dark surface layers (Haploxerolls), Haar family soils at the lower elevations, Cryoborolls on some north slopes and at the higher elevations, soils deeper than 60 inches, nonbouldery Torriorthents and Haplargids, soils with slopes of less than 15 or more than 50 percent, and soils southwest of Tom's Place with Jeffery pine vegetation. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Torriorthents soils are shallow to deep and are somewhat excessively drained. They formed in material weathered in place from granitic rock. The soil surface is covered with 3 to 50 percent boulders, stones, and cobbles. The surface layer is stony to very bouldery, loamy coarse sand or coarse sandy loam, 10 to 60 inches deep over decomposing granitic bedrock. The soil contains 15 to 60 percent rock fragments. The rock fragments tend to be rounded or have rounded edges. A few of the boulders exceed 6 feet in diameter. A thin mat of decomposing pine needles is present beneath crowns of trees.

The Haplargids soils are shallow to deep and are well drained. They formed in material weathered in place from granitic rock. The soil surface is covered with 3 to 50 percent boulders, stones, and cobbles. The surface layer is stony to very bouldery, loamy coarse sand or coarse sandy loam about 10 inches thick. The subsoil is stony to very bouldery sandy clay loam. The soil contains 15 to 60 percent rock fragments. The rock fragments tend to be rounded or have rounded edges. A few of the boulders exceed 6 feet in diameter. Decomposing granitic bedrock ranges from 10 to 60 inches deep. A thin mat of decomposing pine needles is present beneath crowns of trees.

Rock outcrops cover 10 to 50 percent of the surface, but the average coverage is about 20 percent. They project 3 to 20 feet above the soil surface.

Properties:
Permeability of the Torriorthents soils is rapid (6-20 in/hr). The available water capacity is low to very low (0.5-4.0 in). Effective rooting depth is 10 to 60 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.6-7.3). The organic carbon content is 0.4 to 0.6 percent. Runoff is medium. The water erosion condition class is estimated as stable under native

conditions and moderate under bare soil conditions. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of these soils. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Haplargids soils is moderate to moderately slow (0.2-2.0 in/hr). The available water capacity is low to very low (0.8-5.0 in). Effective rooting depth is 10 to 60 inches. Some roots enter cracks in the bedrock and can therefore tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.6-7.3). The organic carbon content is 0.4 to 0.6 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The soil is susceptible to scour erostion if water is concentrated in a channel, due to the detachability of these soils. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

subalpine big sagebrush (*Artemisia tridentata speciformis*)	30%
low sagebrush (*Artemisia arbuscula*)	15%
high altitude buckwheats (*Eriogonum sp.*)	15%
desert bitterbrush (*Purshia glandulosa*)	10%
Sandberg bluegrass (*Poa secunda*)	10%
junegrass (*Koeleria cristata*)	10%
perennial forbs	5%

Open stands of singleleaf pinyon (*Pinus monophylla*) and curlleaf mountain mahogany (*Cercocarpus ledifolius*) grow on many of the shallower soils in this unit, with an understory of the above species. The annual production of air-dry vegetation ranges from 600 to 1,000 pounds per acre. Vegetation covers 25 to 50 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to many steep slopes, and many large rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a severe limitation for fencing due to the rock outcrops and many large rock fragments.
Range site name: Subalpine sagebrush 8-10" p.z. (CA-29-38)
Mahogany slope 12-18" p.z. (NV-26-9)

Wood Products:
This unit is poorly suited to the production of pinyon pine firewood. It can produce 2 to 5 cords per acre in a stand of trees that average 5 inches in diameter at a height of 1 foot. The site index for this unit ranges from 25 to 35, in areas where pinyon pine grows.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are many steep slopes, many large rock fragments, some shallow soils, and access difficulties. This unit is a source of pinyon nuts.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many steep slopes, many large rock fragments and rock outcrops, and some shallow soils. Cuts needed to provide essentially level building sites can expose bedrock. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many steep slopes, many rock fragments, short growing season, and many shallow soils.

158 - Torripsamments - Cinder land association, 15 to 50 percent slopes

Taxonomic Class:
Torripsamments

Setting:
This mapping unit is on volcanic cinder cones. The topography is moderately steep to steep and slightly vertically concave. The native vegetation is shrubs, perennial grasses, and annual forbs. The cinder land supports little or no vegetation. Elevation is 4,000 to 6,500 feet. The mean annual precipitation is 5 to 10 inches, the mean annual air temperature is 47 to 57°F, and the mean 32° frost free season is 125 to 200 days. Mean annual snowfall is 5 to 50 inches.

Percentages:
This unit is 60 percent Torripsamments and 20 percent cinder land. The Torripsamments are on the lower, vegetated areas. The cinder land is on the higher, steeper, unvegetated areas of the unit.

Inclusions:
Included in this unit are small areas of Taboose soils, Avalmount soils, and rock outcrops. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Torripsamments are very deep and somewhat excessively drained. They formed in airfall deposits of basic volcanic ash. The soil surface is covered with 15 to 30 percent fine and medium pumice gravel. The surface layer is gravelly coarse sand about 2 inches thick. The surface 2 or 3 inches has loose consistency. The next layer to a depth of 60 inches or more is loamy coarse sand or gravelly loamy coarse sand. The soil contains about 20 percent fine and medium pumice gravel.

The cinder land is very deep and excessively drained. It is composed of fine to coarse pumice cinders with little or no sand-sized particles. Cinder land has loose consistency.

Properties:
Permeability of the Torripsamments is rapid (6-20 in/hr). Available water capacity is low (4-5 in). Effective rooting depth is 60 inches or more. The

soil is noncalcareous. The soil reaction is neutral (pH 6.6-7.3). The organic carbon content is less than 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion is water is concentrated in a channel, due to the detachability of these noncohesive soils. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Permeability of the cinder land is very rapid (more than 20 in/hr). Available water capacity is very low (less than 1 in). Effective rooting depth is 60 inches or more. Runoff is very slow. The hazard of water erosion is low under both native and bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for a visual resource and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on the Torripsamments is mainly:

Nevada ephedra (*Ephedra nevadensis*)	20%
Fremont dalea (*Dalea fremontii*)	20%
spiny hopsage (*Grayia spinosa*)	15%
desert needlegrass (*Stipa speciosa*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%

Where this unit occurs above an elevation of about 5,500 feet, the dominant shrub is big sagebrush (*Artemisia tridentata*). The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the very sandy textures. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Cinderland

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the loose, sands surface and steep slopes in some areas. This unit has moderate susceptibility to surface scarring by off-road vehicles. Off-pavement vehicle travel requires 4-wheel drive.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and steep slopes in some areas. Cutbanks are not stable and are subject to rapid slumping. Dirt roads on this unit usually do not have a water erosion hazard due to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
The Torripsamments are in capability subclass VIe (26,29), nonirrigated. The cinder land is in capability class VIII. This unit is very poorly suited for irrigated agriculture due to the very coarse textures and steep slopes.

159 - Tuttle very bouldery loamy coarse sand, dry, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, mesic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans and fan terraces on the west side of Owens Valley and near the White Mountains. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans and fan terraces, which are joined together to form long bajadas, are incised with a few shallow washes and steep-sided drainageways. Stringers of stones and boulders radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation ranges from 4,800 to 6,400 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 49 to 54°F, and the mean 32° frost-free season is 130 to 150 days. A 6 to 12-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 50 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 20 percent boulders and stones, 15 percent cobbles, and 20 percent fine gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is brown very bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is yellowish brown and light yellowish brown very stony and extremely stony loamy coarse sand. This layer contains about 55 percent rock fragments consisting of about 25 percent boulders and stones, 20 percent cobbles, and 10 percent gravel.

Inclusions:
Included in this unit are small areas of Tuttle soils with bouldery or extremely bouldery surface layers, soils similar to the Tuttle soil but with light sandy loam textures, Rovana soils, Washoe soils, Washoe Variant soils, rubbleland, moist soils along stream drainages, and soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Tuttle soil is rapid (6-20 in/hr). Available water capacity is very low (1.0-2.5 in). The soil is noncalcareous. The effective rooting depth is 60 inches or more. The soil reaction is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.3 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
This unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community is mainly:

big sagebrush (Artemisia tridentata)	25%
desert needlegrass (Stipa speciosa)	25%
spiny hopsage (Grayia spinosa)	10%
Nevada ephedra (Ephedra nevadensis)	10%
blackbrush (Coleogyne ramosissima)	5%
perennial forbs	5%
Indian ricegrass (Oryzopsis hymenoides)	3%
Nevada bluegrass (Poa nevadensis)	3%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	2%
annual forbs	2%
desert bitterbrush (Purshia glandulosa)	2%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the many rock fragments and sandy textures. This unit has a severe limitation for fencing due to the many large rock fragments.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many large rock fragments. Excavations are impeded by the many large rock fragments. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

160 - Tuttle very bouldery loamy coarse sand, moist, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, mesic Xeric Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans and fan terraces on the west side of Owens Valley and near the White Mountains. It formed in bouldery and stony alluvium from granitic rock sources. Most of the fans and fan terraces, which are joined together to form long bajadas, are incised with shallow washes and a few steep-sided drainageways. Stringers of stones and boulders radiate down the fans from the mouth of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be

rounded or have rounded edges. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation ranges from 4,800 to 6,400 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is 47 to 53°F, and the mean 32° frost-free season is 130 to 150 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 35 to 60 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 20 percent boulders and stones, 15 percent cobbles, and 20 percent fine gravel. The boulders and stones project 1 to 6 feet above the soil surface. The surface layer is brown very bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is yellowish brown and light yellowish brown very stony and extremely stony loamy coarse sand. This layer contains about 60 percent rock fragments consisting of about 25 percent boulders and stones, 25 percent cobbles, and 10 percent gravel.

Plate 29. Profile of Tuttle soil (unit 160) in Round Valley, northwest of Bishop. The large boulder on the right wall of the pit is about 5 feet in diameter and could not be easily excavated by a commercial backhoe.

Inclusions:
Included in this unit are small areas of Tuttle soils with bouldery or extremely bouldery surface layers, soils similar to the Tuttle soil but with light sandy loam textures, Rovana soils, Washoe soils, Washoe Variant soils, rubbleland, moist soils along stream drainages, and soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Properties:
Permeability of this Tuttle soil is rapid (6-20 in/hr). Available water capacity is very low (1.0-2.5 in). The soil is noncalcareous. The effective rooting depth is 60 inches or more. The soil reaction is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.3 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
This unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community is mainly:

desert bitterbrush (*Purshia glandulosa*)	25%
big sagebrush (*Artemisia tridentata*)	20%
desert needlegrass (*Stipa speciosa*)	20%
Nevada ephedra (*Ephedra nevadensis*)	5%
blackbrush (*Coleogyne ramosissima*)	5%
perennial forbs	5%
Indian ricegrass	3%
Nevada bluegrass (*Poa nevadensis*)	3%
antelope bitterbrush (*Purshia tridentata*)	3%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	2%
annual forbs	2%

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 40 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is very poorly suited to rangeland seeding due to the many rock fragments and sandy textures. This unit has a severe limitation for fencing due to the many large rock fragments.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many large rock fragments and sandy surface layer. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many large rock fragments. Excavations are impeded by the many large rock fragments.

Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs (26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

161 - Tuttle - Rovana complex, dry, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, mesic Xeric Torriorthents (Tuttle)
Sandy, mixed, mesic Xeric Torriorthents (Rovana)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces at the eastern base of the Sierra Nevada. Most of these fans and fan terraces, which are joined together to form long bajadas, are incised with shallow washes and a few steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouths of canyons. A few of the boulders are more than 6 feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 6,000 feet. The mean annual precipitation is 8 to 10 inches, the mean annual air temperature is 49 to 54°F, and the mean 32° frost-free is 130 to 160 days. A 6-inch mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 30 to 50 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Tuttle soil and 25 percent Rovana soil. The Tuttle soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of very bouldery Tuttle soils, soils similar to the Tuttle or Rovana soils that have coarse sandy loam texture, Washoe soils, Washoe Variant soils, rubbleland, moist soils along stream drainageways, and soils with slope of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Tuttle soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 8 percent boulders and stones, 10 percent cobbles, and 25 percent gravel. The surface layer is brown bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is yellowish brown and light yellowish brown very stony and extremely stony loamy coarse sand. It contains about 60 percent rock fragments consisting of about 25 percent boulders and stones, 10 percent cobbles, and 25 percent gravel.

The Rovana soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 1 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The surface layer is brown gravelly loamy coarse sand about 12 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is pale brown loamy coarse sand and gravelly loamy coarse sand about 30 inches thick. This layer contains about 30 percent rock fragments consisting of about 1 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The next layer to a depth of 60 inches or more is very cobbly loamy coarse sand. This layer contains about 20 percent cobbles and 20 percent gravel.

Properties:
Permeability of the Tuttle soil is rapid (6-20 in/hr). Available water capacity is very low (1.2-2.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.3 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.
Permeability of the Rovana soil is rapid (6-20 in/hr). Available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.35 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert needlegrass (Stipa speciosa)	25%
big sagebrush (Artemisia tridentata)	25%
spiny hopsage (Grayia spinosa)	5%
Nevada ephedra (Ephedra nevadensis)	5%
California buckwheat (Eriogonum fasciculatum)	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	5%
blackbrush (Coleogyne ramosissima)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
perennial forbs	3%
bottlebrush squirreltail (Sitanion hystrix)	2%
Nevada bluegrass (Poa nevadensis)	2%
annual forbs	2%
desert bitterbrush (Purshia glandulosa)	1%

The annual production of air-dry vegetation ranges from 300 to 500 pounds per acre. Vegetation covers 20 to 30 percent of the soil surface. This unit is

very poorly suited to rangeland seeding due to the sandy textures and many large rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many large rock fragments of the Tuttle soil and sandy textures.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the many large rock fragments in the Tuttle soil. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the many large rock fragments in the Tuttle soil. Excavations are impeded by the many large rock fragments. Some cutbanks in the Rovana soil are not stable and are subject to slumping. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

162 - Tuttle - Rovana complex, moist, 5 to 15 percent slopes

Taxonomic Class:
Sandy-skeletal, mixed, mesic Xeric Torriorthents (Tuttle)
Sandy, mixed mesic Xeric Torriorthents (Rovana)

Setting:
This mapping unit is on bouldery and stony alluvial fans and fan terraces at the eastern base of the Sierra Nevada. Most of these fans and fan terraces, which are joined together to form long bajadas, are incised with a few shallow washes and steep-sided drainageways. Stringers of boulders and stones radiate down the fans from the mouth of canyons. A few of the boulders are more than six feet in diameter. Rock fragments tend to be rounded or have rounded edges. The topography is moderately to strongly sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 6,200 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is 47 to 53°F, and the mean 32° frost-free is 130 to 160 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 35 to 60 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Tuttle soil and 25 percent Rovana soil. The Tuttle soil is more common where there are more surface boulders and stones. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of very bouldery Tuttle soils, soils similar to the Tuttle or Rovana soils that have coarse sandy loam texture, Washoe soils, Washoe Variant soils, rubbleland, moist soils along stream drainageways, and soils with slope of less than 5 or more than 15 percent. Included areas make up about 25 percent of the total acreage.

Typical Profile:
The Tuttle soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 8 percent boulders and stones, 10 percent cobbles, and 25 percent gravel. The surface layer is brown bouldery loamy coarse sand about 12 inches thick. The next layer to a depth of 60 inches or more is yellowish brown and light yellowish brown very stony and extremely stony loamy coarse sand. It contains about 60 percent rock fragments consisting of about 25 percent boulders and stones, 10 percent cobbles, and 25 percent gravel.

The Rovana soil is very deep and somewhat excessively drained. It formed in alluvium from granitic rock sources. Typically, the soil surface is covered with about 1 percent boulders and stones 2 percent cobbles, and 25 percent gravel. The surface layer is brown gravelly loamy coarse sand about 12 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is pale brown loamy coarse sand and gravelly loamy coarse sand about 30 inches thick. This layer contains about 30 percent rock fragments consisting of about 1 percent boulders and stones, 2 percent cobbles, and 25 percent gravel. The next layer to a depth of 60 inches or more is very cobbly loamy coarse sand. This layer contains about 20 percent cobbles and 20 percent gravel.

Properties:
Permeability of the Tuttle soil is rapid (6-20 in/hr). Available water capacity is very low (1.2-2.5 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.3 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Rovana soil is rapid (6-20 in/hr). Available water capacity is low (2.5-5.0 in). Effective rooting depth is 60 inches or more. The soil is noncalcareous and is slightly acid to neutral (pH 6.5-7.3). The organic carbon content is 0.35 to 0.6 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

desert bitterbrush (*Purshia glandulosa*)	20%
desert needlegrass (*Stipa speciosa*)	25%
big sagebrush (*Artemisia tridentata*)	25%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
blackbrush (*Coleogyne ramosissima*)	3%
perennial forbs	3%
Nevada bluegrass (*Poa nevadensis*)	2%
Nevada ephedra (*Ephedra nevadensis*)	2%
annual forbs	2%
green Mormon tea (*Ephedra viridis*)	2%
bottlebrush squirreltail (*Sitanion hystrix*)	2%
California buckwheat (*Eriogonum fasciculatum*)	2%
spiny hopsage (*Grayia spinosa*)	2%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	T

The annual production of air-dry vegetation ranges from 500 to 700 pounds per acre. Vegetation covers 20 to 40 percent of the soul surface. This unit is poorly or very poorly suited to rangeland seeding due to the sandy textures and many large rock fragments. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the many large stones of the Tuttle soil and sandy textures.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-32)

Plate 30. Typical landscape of unit 162 in Round Valley, west of Bishop. Looking west up Pine Creek Canyon towards the Sierra Nevada.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the many large rock fragments in the Tuttle soil. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the many large rock fragments in the Tuttle soil. Excavations are impeded by the many large rock fragments. Some cutbanks in the Rovana soil are not stable and are subject to slumping. Significant rilling by water may occur on dirt roads that run up and down the slope. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIs(26), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many large rock fragments and low available water capacity.

163 - Tuttle Variant sandy loam, 0 to 5 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed, nonacid, mesic Xeric Torriorthents

Setting:
This very deep, well drained soil is on alluvial fans and glacial outwash plains, north of Bishop. It formed in gravelly or cobbly alluvium from mixed rock sources. Some rhyolitic volcanic ash is in the surface layer. The topography is nearly level to gently sloping. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,000 to 7,200 feet. The mean annual precipitation is 9 to 12 inches, the mean annual air temperature is 42 to 48°F, and the mean 32° frost-free season is about 125 days. A two-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 40 to 70 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 10 percent fine and medium gravel. The surface layer is pale brown sandy loam about 8 inches thick. The next layer is pale brown very gravelly or very cobbly sandy loam about 24 inches thick. This layer contains about 35 percent gravel and 15 percent cobbles. The next layer to a depth of 60 inches or more is light yellowish brown sand, loamy sand, or gravelly sandy loam. In some areas the surface layer is gravelly sandy loam.

Inclusion:
Included in this unit are small areas of Cashbaugh soils, Buscones soils, Rovana soils in drainageways, Tuttle soils, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Tuttle Variant soil is moderately rapid (2-6 in/hr). The

available water capacity is low (3.0-4.0 in.). Effective rooting depth is 60 inches or more. The soil is noncalcareous. The soil reaction is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.4 to 0.6 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions, although compacted areas are subject to some rill erosion. The soil is susceptible to scour erosion if water is concentrated in a channel. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (*Artemisia tridentata*)	30%
antelope bitterbrush (*Purshia tridentata*)	30%
Thurbers needlegrass (*Stipa thurberiana*)	15%
basin wildrye (*Elymus cinereus*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
perennial forbs	5%
Douglas rabbitbrush (*Chrysothamnus viscidiflorus*)	3%
green Mormon-tea (*Ephedra viridis*)	3%
common pricklygilia (*Leptodactylon pungens*)	2%

The annual production of air-dry vegetation ranges from 600 to 800 pounds per acre. Vegetation covers 30 to 35 percent of the soil surface. The suitability of this unit for rangeland seeding is fair to poor due to low precipitation and low available water capacity. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to the rock fragments.
Range site name: Ashy loamy sand 10-14" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the many rock fragments. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many rock fragments. Excavations may be impeded by these rock fragments.

Interpretive Groups:
This mapping unit is in capability unit IVe(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the many rock fragments and short growing season.

164 - Victorville - Villa families complex, 0 to 2 percent slopes

Taxonomic Class:
Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents (Victorville) family
Sandy, mixed, thermic Typic Torrifluvents (Villa family)

Setting:
This mapping unit is on the valley floor in Owens Valley. The topography is nearly level. The native vegetation is mainly salt-and sodium-tolerant desert shrubs and grasses. Elevation is 3,600 to 4,300 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 55 to 59°F, and the mean 32° frost-free season is 175 to 225 days. Mean annual snowfall is less than 2 inches.

Percentages:
This unit is 45 percent Victorville family soils and 35 percent Villa family soils. The components of this unit are so intricately intermingled that is was not practical to map them separately at the scale used. The Villa family soils are more common in areas of stabilized sand dunes; the Victorville family soils are more common on the flat, low-lying areas.

Inclusions:
Included in this unit are small areas of soils that are not saline-sodic, soils with 15 to 35 percent gravel, playa areas devoid of vegetation, soils with sodic subsoils (Natrargids), soils that have clay loam or silty clay loam textures, small sand dunes, and soils with a high water table that remain moist in summer and fall. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Victorville family soils are very deep and well drained. They formed in alluvium from mixed rock sources. Typically, the surface is covered with about 10 percent fine gravel. The surface layer is light gray loam, very fine sandy loam, sandy loam, or fine sand about 12 inches thick. The next layer to a depth of 60 inches or more is stratified light gray fine sand, loamy very fine sand, sandy loam, loam, and very fine sandy loam.

The Villa family soils are very deep and well drained. They formed in sandy alluvium and eolian deposits from mixed rock sources. Typically, the surface is covered with about 10 percent fine gravel. The surface layer is light gray sand, coarse sand, or fine sand about 4 inches thick. The surface 2 or 3 inches has loose consistency. The next layer to a depth of 60 inches or more is stratified light gray sand, loamy sand, coarse sand, fine sand, sandy loam, and silt loam.

Properties:
Permeability of the Victorville family soils is moderate (0.6-2.0 in/hr). The available water capacity is low (3-5 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout most of the profile, and is very strongly alkaline (pH 9.5-10.5) throughout most of the profile. The electrical conductivity of the saturation extract is 2 to 16 mmhos/cm and the exchangeable sodium percentage is 15 to 80 percent. The soil contains 10 to 30 ppm of boron. The salt, boron, and exchangeable sodium content increases with depth, the surface foot of soil being relatively free of these. Runoff is ponded or very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Villa family soils is moderate (0.6-2.0 in/hr). The

available water capacity is low (2.5-4.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile and is very strongly alkaline (pH 9.5-10.5). The electrical conductivity of the saturation extract is 2 to 8 mmhos/cm and the exchangeable sodium percentage is 15 to 80 percent. The soil contains 10 to 30 ppm of boron. The salt, boron, and exchangeable sodium content increases with depth, the surface foot of soil being relatively free of these. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is high under both native and bare soil conditions. This unit was subject to periodic flooding until water diversions greatly reduced the flow of the Owens River.

Use:
At present, this unit is used for wildlife habitat.

Plate 31. Typical landscape of unit 164 in southern Owens Valley. Small playa area (unit 143) in middle ground. Looking northwest towards Alabama Hills and Sierra Nevada.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

black greasewood (*Sarcobatus vermiculatus*)	25%
shadscale (*Atriplex confertifolia*)	25%
allscale saltbush (*Atriplex polycarpa*)	15%
Mojave seablite (*Suaeda torreyana*)	10%
Parry saltbush (*Atriplex parryi*)	5%
white bursage (*Franseria dumosa*)	5%
inland saltgrass (*Distichlis stricta*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%

The annual production of air-dry vegetation ranges from 100 to 200 pounds per acre. Vegetation covers 5 to 10 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation, many sandy textures, and saline-sodic conditions. This unit has a moderate to severe limitation for fencing due to the sandy textures and excess salts. Range site name: Alkali sand 4-6" p.z. (CA-29-47)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the saline-sodic conditions and dustiness. This unit has moderate susceptibility to surface scarring by off-road vehicles, especially the Victorville family soils.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the high content of salts and exchangeable sodium and the sandy textures of the Villa soil. Cutbanks are not stable and are subject to slumping. Sulfate-resistant concrete should be used in any construction project.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the high content of salts, exchangeable sodium and boron, low available water capacity, and the hazard of soil blowing.

165 - Water

Taxonomic Class:
none

Setting:
This mapping unit is on perennial streams, lakes, and ponds. In most years these areas are covered with enough water to prevent the growth of terrestrial plants. In years of severe drought, some of the smaller bodies of water may dry up.

Inclusions:
Included in this unit are small areas of wet soils with high water tables (Aquents). Included areas make up about 5 percent of the total acreage.

166 - Whitewolf - Toquerville families association, 15 to 50 percent slopes

Taxonomic Class:
Mixed, thermic Xeric Torripsamments (Whitewolf family)
Mixed, thermic Lithic Torripsamments (Toquerville family)

Setting:
This mapping unit is on hills within Owens Valley and along the Sierra Nevada escarpment near Cartago. The topography is moderately steep to steep. The native vegetation is mainly mixed desert shrubs, perennial grasses, and

annual forbs. Elevation is 4,500 to 5,600 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is about 55° F, and the mean 32° frost-free season is 150 to 200 days. Mean annual snowfall is about 15 inches.

Percentages:
This unit is 60 percent Whitewolf family soils and 20 percent Toquerville family soils. The Whitewolf family soils are on the lower parts of the hills with concave slopes of 15 to 40 percent, and the Toquerville family soils are around the hilltops with slopes of 30 to 50 percent.

Inclusions:
Included in this unit are small areas of shallow soils over decomposing granitic bedrock and soils with more than 35 percent rock fragments (associated with the Toquerville soil), Haar family soils on higher north slopes, soils with sandy loam subsoils, rock outcrops (mostly associated with the Toquerville soil), and soils with slopes of less than 15 or more than 50 percent. The rock outcrops cover 0 to 10 percent of the area, but the average coverage is about 3 percent. They extend 2 to 20 feet above the soil surface. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Whitewolf family soils are moderately deep to very deep and are somewhat excessively drained. The soils formed in slope wash and material weathered in place from granitic rock. Typically, the surface layer is light brownish gray coarse sand about 2 inches thick. The surface 2 or 3 inches has loose consistency. The next layer is light brownish gray and brown loamy coarse sand. The soil contains 5 to 15 percent rock fragments consisting of fine gravel and a few cobbles. Decomposing granitic bedrock is at a depth of 20 to more than 60 inches deep. The deeper soils occur near the base of the hills and the shallower soils occur farther upslope.

The Toquerville family soils are shallow or very shallow and are somewhat excessively drained. It formed in residuum weathered from granitic rock. Typically, the surface is covered with about 25 percent gravel and cobbles. Stones and boulders are present in some areas. The surface layer is bouldery, stony, cobbly, or gravelly, sand or loamy coarse sand over hard, granitic bedrock. The surface 2 or 3 inches has loose consistency. Hard, granitic bedrock occurs at a depth of 3 to 20 inches. The soil contains about 25 percent rock fragments consisting of gravel and cobbles, and in some areas stones and boulders also.

Properties:
Permeability of the Whitewolf family soils is rapid (6-20 in/hr). Available water capacity is very low to low (1.5-5.0 in). Effective rooting depth is 20 to more than 60 inches. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water in concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Permeability of the Toquerville family soils is rapid (6-20 in/hr). Available water capacity is very low (0.1-1.5 in). Effective rooting depth is 3 to 20 inches. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions. The soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

spiny hopsage (*Grayia spinosa*)	10%
Nevada ephedra (*Ephedra nevadensis*)	10%
California buckwheat (*Eriogonum fasciculatum*)	10%
Fremont dalea (*Dalea fremontii*)	10%
Cooper goldenbush (*Haplopappus cooperii*)	10%
white burrobush (*Hymenoclea salsola*)	10%
desert needlegrass (*Stipa speciosa*)	10%
longspine horsebrush (*Tetradymis axillaris*)	5%
Indian ricegrass (*Oryzopsis hymenoides*)	5%
annual forbs	5%
blackbrush (*Coleogyne ramosissima*)	3%
bud sagebrush (*Artemisia spinescens*)	3%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	3%
common winterfat (*Eurotia lanata*)	3%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers about 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to steep slopes, low precipitation and sandy textures. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit has a moderate to severe limitation for fencing due to some steep slopes, sandy textures, and some shallow soils.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and some steep slopes. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are some steep slopes, sandy textures, and the shallow bedrock and rock outcrops of the Toquerville family soil. Cuts needed to provide essentially level building sites can expose bedrock. Cutbanks are not stable and are subject to slumping in the deeper Whitewolf family soils. Buildings and roads on the Whitewolf family soils should be designed to offset the limited ability of these soils to support a load. Access roads should be designed to control surface runoff and help stabilize cut slopes.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the steep slopes, sandy textures and shallow depths of the Toquerville family soil.

167 - Xeric Torriorthents, 0 to 9 percent slopes

Taxonomic Class:
Xeric Torriorthents

Setting:
These very deep, well drained soils are on remnants of old lake terraces near Crowley Lake. They formed in ashy and mixed allumium over stratified lake sediments derived dominantly from diatomaceous and mixed alluvium. Slopes are nearly level to gently rolling. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,800 to 7,000 feet. The mean annual precipitation is 9 to 11 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A one to two-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is about 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
The surface layer is sandy loam or loamy sand. The next layer is sandy loam. The next layer to a depth of at least 60 inches is stratified sandy clay loam and silty clay loam. Strata of clay occur in the lower layers in some areas. Depth to the stratified lake sediments ranges from 10 to 40 inches. Some layers have hardened into rock-like material. A fragile surface layer with vesicular pores is present in some areas.

Inclusions:
Included in this unit are small areas of Brantel soils in drainageways, Cashbaugh soils, Buscones soils, soils with lake sediments at the surface, slightly saline-sodic soils in low spots, and soils with slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of the Xeric Torriorthents is moderate to very slow (less than 0.06 to 2.0 in/hr). The available water capacity is low to moderate (4.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous in some areas. The soil reaction is slightly acid (pH 6.1-6.5) in the surface layer, and neutral to moderately alkaline (pH 6.6-8.0) in the lower layers. Runoff is slow to medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions, especially if the lower soil layers are exposed. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and some diatomite mining.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

big sagebrush (Artemisia tridentata)	30%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	15%
little horsebrush (Tetradymia glabrata)	10%
green Mormon tea (Ephedra viridis)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
western needlegrass (Stipa occidentalis)	5%
needle and thread grass (Stipa comata)	5%
inland saltgrass (Distichlis stricta)	5%
annual forbs	3%
perennial forbs	3%

The annual production of air-dry vegetation ranges from 400 to 600 pounds per acre. Vegetation covers 20 to 25 percent of the soil surface. Rubber rabbitbrush seems to establish itself well in burned or disturbed areas. This unit is poorly suited to rangeland seeding due to many sandy textures and low precipitation. This unit is suited for fencing.
Range site name: Sandy 10-12" p.z. (CA-26-44)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and dustiness. This unit has low to moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the moderate to very slow permeability and the sandy surface layer. If the soil is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using sandy backfill.

Interpretive Groups:
This mapping unit is in capability unit IVe-1(26), nonirrigated. This unit is poorly suited for irrigated agriculture due to the sandy surface textures and the short growing season.

168 - Xeric Torriorthents, sodic, 0 to 9 percent slopes

Taxonomic Class:
Xeric Torriorthents

Setting:
These very deep, well drained soils are on lake terraces near Mono Lake. They formed in lake sediments derived from volcanic ash and mixed rock sources. The native vegetation is mainly sodium-tolerant desert shrubs. Elevation is 6,400 to 6,700 feet. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A one-foot mantle of snow may cover this unit in winter for brief periods. Mean annual snowfall is 40 to 60 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
The surface layer is silty clay loam or silt loam about 23 inches thick. The next layer is white sand (volcanic ash) about 9 inches thick. The next layer to a depth of 60 inches or more is silty clay loam or silt loam. The layers of silt loam and silty clay loam contain significant quantities of very fine volcanic ash.

Inclusions:
Included in this unit are small areas of Alamedawell soils, Aquic Torriorthents, playa areas, Brantel soils, Avalmount soils on Paoha and Negit Islands, some isolated tufa outcrops, and soils with slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of the Xeric Torriorthents is slow to very slow (less than 0.06 to 0.2 in/hr). The available water capacity is high (7.0-10.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to very strongly alkaline (pH 8.2-10.5). The electrical conductivity of the saturation extract is 1 to 15 mmhos/cm and the exchangeable sodium percentage is 15 to 90 percent. The soil contains 2 to 70 ppm of boron. The organic carbon content is about 0.2 percent. Runoff is ponded on the nearly level areas and rapid on the sloping areas. The water erosion condition is slight to moderate under both native and bare soil conditions. Runoff water tends to pond in small depressional areas of this unit. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil can be very dusty if it is disturbed when dry.

Use:
At present, this unit is used for wildlife habitat and limited grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

black greasewood (*Sarcobatus vermiculatus*)	50%
spiny hopsage (*Grayia spinosa*)	10%
inland saltgrass (*Distichlis stricta*)	10%
fourwing saltbush (*Atriplex canescens*)	10%
shadscale (*Atriplex confertifolia*)	5%

The annual production of air-dry vegetation ranges from 50 to 100 pounds per acre. Vegetation covers about 5 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the excess sodium in the soil. Rubber rabbitbrush seems to establish itself well in disturbed areas. This unit has a slight to moderate limitation for fencing due to excess salts. Range site name: Sodic flat 5-10" p.z. (NV-26-21)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the excess sodium and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles. The soil is slippery and easily scarred when wet, and it is dusty when dry.

Plate 32. Typical landscape of unit 168 on the east side of Mono Lake. Note the sparse vegetation. These soils contain excessive amounts of sodium and boron. The shrubs are black greasewood (Sarcobatus vermiculatus). Looking southwest towards the Sierra Nevada and the peaks on the eastern edge of Yosemite National Park.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the excess sodium, high shrink-swell potential, and limited load-supporting capacity. If this soil is used for septic tank absorption fields, the limitation of slow permeability can be overcome by using sandy backfill for the trenches and by increasing the size of the absorption field. Where slopes are more than 5 percent, significant water rilling may occur on dirt roads that run up and down the slope. Roads should be designed to control surface runoff and avoid excess rilling. These soils are sticky and plastic when wet in the winter and spring months.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(26), nonirrigated. This unit is very poorly suited for irrigated crops due to the excess sodium, excess boron, moderately fine textures, and the short growing season.

169 - Xeric Torriorthents, ashy - Durorthids, ashy complex, 0 to 2 percent slopes

Taxonomic Class:
Xeric Torriorthents
Durorthids

Setting:
This mapping unit is on old beach areas around Mono Lake. The topography is smooth and nearly level. The native vegetation is perennial grasses and some scattered shrubs. Elevation is 6,300 to 6,500 feet. The mean annual precipitation is 8 to 12 inches, the mean annual air temperature is about 45°F, and the mean 32° frost-free season is about 125 days. A one to two-foot mantle of snow may cover this unit in winter for brief to extended periods. Mean annual snowfall is 40 to 70 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent. The mean annual soil temperature is about 49°F.

Percentages:
This unit is 60 percent Xeric Torriorthents, ashy and 20 percent Durorthids, ashy. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Brantel soils, Brantel Variant soils, Aquents, Aquic Torriorthents, playa areas devoid of vegetation, soils with exposed hardpan on the soil surface, stabilized sand dunes, soils with slopes of more than 2 percent, and some isolated tufa towers. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Xeric Torriorthents are very deep and somewhat excessively drained. They formed in alluvium and airfall deposits of rhyolitic volcanic ash. Typically, the surface layer is light gray sand, coarse sand, gravelly coarse sand, or fine sandy loam. The surface 2 or 3 inches has loose consistency. The next layer to a depth 60 inches or more is stratified silt loam, coarse sand, fine sandy loam, sand, and gravelly sand. The lower layer contains about 10 percent pumice gravel overall, but some thin strata contain up to 35 percent gravel.

The Durorthids are shallow or moderately deep, and are somewhat excessively drained or well drained. They formed in alluvium and airfall deposits of rhyolitic volcanic ash. Typically, the surface layer is light gray gravelly sand, loamy sand, or gravelly coarse sand. The surface 2 or 3 inches has loose consistency. The next layer is a platy hardpan (tufa layer) about 4 inches thick. The next layer to a depth of 60 inches or more is estimated to be stratified coarse sand, loamy sand, and gravelly sand. Depth to the hardpan ranges from 1 to 40 inches. The soil contains about 10 percent pumice gravel overall, but some thin strata contain up to 30 percent gravel.

Properties:
Permeability of the Xeric Torriorthents is moderate to moderately rapid (0.6-6.0 in/hr). The available water capacity is moderate (5.0-7.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous in

most layers and is mildly to strongly alkaline (pH 7.4-8.5). The electrical conductivity of the saturation extract is less than 4 mmhos/cm. The exchangeable sodium percentage is less than 10 percent. The organic carbon content is less than 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of these noncohesive soils. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Permeability of the Durorthids is rapid (6-20 in/hr) above the hardpan and very slow (less than 0.6 in/hr) through the hardpan. The available water capacity is low to very low (0.1-4.0 in). Effective rooting depth is 1 to 40 inches. The soil is calcareous in most layers and is mildly to moderately alkaline (pH 7.4-8.0). The electrical conductivity of the saturation extract is less than 2 mmhos/cm. The exchangeable sodium percentage is less than 5 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of these noncohesive soils. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions.

Plate 33. Typical landscape of unit 169 on south shore of Mono Lake. Looking southwest towards the Mono Craters.

Use:
At present, this unit is used for wildlife habitat and recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

inland saltgrass (Distichlis stricta)	60%
rubber rabbitbrush (Chrysothamnus nauseosus)	20%
Russian thistle (Salsola sp.)	10%

The annual production of air-dry vegetation ranges from 100 to 200 pounds per acre. Vegetation covers about 10 percent of the soil surface. Big sagebrush and antelope bitterbrush may eventually become established on this unit. This unit is very poorly suited to rangeland seeding due to the sandy surface textures and some shallow hardpans. This unit has a severe limitation for fencing due to the loose, sandy textures and some shallow hardpans.
Range site name: Alkali ashy sand 10-12" p.z. (CA-26-33)

Plate 34. Tufa towers on unit 169 at southern shore of Mono Lake. Looking northwest toward the Sierra Nevada.

Recreational Development:
If this unit is used for recreational purposes, the main limitation is the sandy surface layers. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the hardpan in the Durorthids soil. Cutbanks are not stable and are subject to slumping. Excavation for building sites may be impeded in some areas by the hardpan. Conventional septic tank systems may have a

problem with groundwater contamination. Dirt roads on this unit usually do not have a water erosion hazard to the rapid permeability, however traction can be a problem unless a finer-textured binder is added to the road.

Interpretive Groups:
This mapping unit is in capability subclass VIe(26), nonirrigated. This unit is very poorly suited to irrigated agriculture due to the sandy surface textures, short growing season, and hardpan of the Durorthids soil.

170 - Xerollic Durorthids, 2 to 9 percent slopes

Taxonomic Class:
Xerollic Durorthids

Setting:
These shallow to moderately deep, well drained soils are on gently sloping to moderately sloping alluvial fans. They formed in sandy alluvium derived dominantly from granitic or pyroclastic rock sources. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,400 to 5,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is about 54°F, and the mean 32° frost-free season is about 150 days. Mean annual snowfall is about 15 inches. The mean annual soil temperature is about 59°F.

Typical Profile:
Typically, the soil is pale brown gravelly loamy sand and gravelly loamy coarse sand about 10 to 40 inches deep over a continuous, strongly silica-cemented hardpan. In some areas the surface layer is gravelly loamy sand. The soil contains 5 to 25 percent gravel.

Inclusions:
Included in this unit are small areas of Thibau soils, Hammil soils, Chidago soils, Honova soils, soils similar to the Xerollic Durorthids that have a weak hardpan (Haploxerollic Durorthids), soils that have a mesic soil temperature regime and support big sagebrush vegetation, and soils that have slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of the Xerollic Durorthids is rapid (6-20 in/hr) above the hardpan. The available water capacity is very low (less than 2.5 in). Effective rooting depth is 10 to 40 inches. The soil is noncalcareous and is neutral to mildly alkaline (pH 6.8-7.5). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of these noncohesive soils. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing, wildlife habitat, and as a source of roadfill material.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Nevada ephedra (*Ephedra nevadensis*)	15%
Fremont dalea (*Dalea fremontii*)	15%
spiny hopsage (*Grayia spinosa*)	15%
longspine horsebrush (*Tetradymia axillaris*)	10%
desert needlegrass (*Stipa speciosa*)	10%
Indian ricegrass (*Oryzopsis hymenoides*)	10%
common winterfat (*Eurotia lanata*)	5%
needleleaf rabbitbrush (*Chrysothamnus teretifolius*)	5%
annual forbs	5%

The annual production of air-dry vegetation ranges from 200 to 400 pounds per acre. Vegetation covers 10 to 20 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation, sandy textures, and the hardpan. Rubber rabbitbrush seems to establish itself well in burned of disturbed areas. This unit has a moderate to severe limitation for fencing due to the hardpan.
Range site name: Stony granitic fan 6-8" p.z. (CA-29-30)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and shallow hardpan in some areas. This unit has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the hardpan. Excavation is impeded by the hardpan. The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(29), nonirrigated. This unit is poorly suited for irrigated agriculture due to the hardpan and sandy textures.

171 - Yellowrock sand, 0 to 5 percent slopes

Taxonomic Class:
Sandy, mixed, thermic Typic Torriorthents

Setting:
This very deep, somewhat excessively drained soil is on alluvial fans and terraces near Owens Lake. It formed in alluvium from mixed rock sources. The topography is nearly level to gently sloping. Some steep-sided dry washes are present. The native vegetation is salt and sodium-tolerant desert shrubs. Elevation is 3,600 to 3,800 feet. The mean annual precipitation is

about 4 inches, the mean annual air temperature is 58 to 60°F, and the mean 32° frost-free season is about 225 days. Mean annual snowfall is less than 2 inches. There is a rare hazard of flash flooding is summer.

Typical Profile:
Typically, the surface layer is white sand about 3 inches thick. The next layer to a depth of 60 inches or more is stratified light gray loamy sand and gravelly sand. Some thin layers of very gravelly sand are present in this layer. The soil contains an average of about 10 percent fine gravel. In some areas the surface layer is well sorted, windblown sand.

Inclusions:
Included in this unit are small areas of saline-sodic Cajon soils, Halloran Variant soils, saline-sodic Arizo soils, and soils with slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Yellowrock soil is rapid (6-20 in/hr). The available water capacity is low (2.5-4.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is very strongly alkaline (pH 9.0-10.5). The electrical conductivity of the saturation extract is 4 to 12 mmhos/cm (in the lower layer), and the exchangeable sodium percentage is 15 to 90. The soil contains about 30 ppm of boron. The organic carbon content is less than 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is moderate under native conditions and high under bare soil conditions. This unit receives saline dust from nearby dry Owens Lake during windy weather.

Use:
At present, this unit is used for wildlife habitat and limited recreation.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

Mojave seablite (Sueda torreyana)	30%
annual forbs	30%
shadscale (Atriplex confertifolia)	10%
Parry saltbush (Atriplex parryi)	10%
Indian ricegrass (Oryzopsis hymenoides)	10%
allscale saltbush (Atriplex polycarpa)	2%
black greasewood (Sarcobatus vermiculatus)	2%
inland saltgrass (Distichlis stricta)	2%

The annual production of air-dry vegetation ranges from 10 to 50 pounds per acre. Vegetation covers less than 5 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and strong saline-sodic condition. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Alkali sand 4-6" p.z. (CA-29-47)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the sandy textures and the soil blowing hazard. Off-pavement vehicle travel requires 4-wheel drive. This unit has low susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the sandy textures and the strong saline-sodic condition. Cutbanks are not stable and are subject to slumping. Sulfate-resistant concrete should be used in any construction project. The possibility of settlement can be minimized by compacting the building site before construction begins.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the sandy textures, strong saline-sodic condition, and the soil blowing hazard.

Plate 35. Typical profile of Yellowrock sand in unit 171; southeast side of Owens Lake. The soil is strongly saline-sodic.

172 - Yellowrock - Seaman complex, 2 to 5 percent slopes

Taxonomic Class:
Sandy, mixed, thermic Typic Torriorthents (Yellowrock)
Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents (Seaman)

Setting:
This mapping unit is on the lower slopes of alluvial fans on the east side of Owens Valley. The topography is slightly concave and gently sloping. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,700 to 4,400 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 55 to 60°F, and the mean 32° frost-free season is 150 to 225 days. Mean annual snowfall is less than 5 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 50 percent Yellowrock soil and 30 percent Seaman soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Yermo soils, Victorville family soils, Villa family soils, Yellowrock and Seaman soils that contain some stones, and soils with slopes of less than 2 or more than 5 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Yellowrock soil is very deep and somewhat excessively drained. It formed in alluvium from mixed rock sources. Typically, the surface layer is light gray loamy sand about 4 inches thick. The next layer is light gray sandy loam about 8 inches thick. It is usually a fragile layer with vesicular pores. The next layer to a depth of 60 inches or more is stratified loamy sand, gravelly coarse sand, gravelly sandy loam, and very cobbly loamy sand. The soil contains an average of about 15 percent rock fragments consisting mostly of gravel, with a trace of cobbles.

The Seaman soil is very deep and well drained. It formed in alluvium from mixed rock sources. Typically, the surface layer is light gray loamy sand about 3 inches thick. The next layer is very pale brown sandy loam about 3 inches thick. It is usually a fragile layer with vesicular pores. The next layer to a depth of 60 inches or more is stratified sandy loam, loamy sand, and silt loam. The soil contains an average of about 5 percent gravel.

Properties:
Permeability of the Yellowrock soil is moderately rapid (2-6 in/hr). The available water capacity is low (3.0-4.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to very strongly alkaline (pH 7.9-9.5). The electrical conductivity of the saturation extract is 0.4 to 2.0 mmhos/cm, and the exchangeable sodium percentage is 1 to 30 percent. The soil contains 0.5 to 4.0 ppm of boron. The salt, boron, and exchangeable sodium content increase with depth, the surface foot of soil being relatively free of these. The organic carbon content is less than 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under

both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Permeability of the Seaman soil is moderately rapid (2-6 in/hr). The available water capacity is moderate (5.0-6.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to very strongly alkaline (pH 7.9-9.5). The electrical conductivity of the saturation extract is 0.4 to 2.0 mmhos/cm, and the exchangeable sodium percentage is 1 to 30 percent. The soil contains 0.5 to 4.0 ppm of boron. The salt, boron, and exchangeable sodium content increase with depth, the surface foot of soil being relatively free of these. The organic carbon content is about 0.2 percent. Runoff is very slow. The water erosion condition class is estimated as stable under both native and bare soil conditions. However, the soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for wildlife habitat and grazing.

Plate 36. Typical landscape of unit 172 in southern Owens Valley. Unit 174 is on the alluvial fans at the base of the mountains. The darker tone of unit 174 is due to the presence of creosotebush, which does not grow on unit 172. Looking southeast toward the Inyo Mountains.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

white bursage (Franseria dumosa)	50%
shadscale (Atriplex confertifolia)	10%
allscale saltbush (Atriplex polycarpa)	10%
white burrobush (Hymenoclea salsola)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
fourwing saltbush (Atriplex canescenss)	5%
desert needlegrass (Stipa speciosa)	5%
annual forbs	2%

The annual production of air-dry vegetation ranges from 50 to 100 pounds per acre. Vegetation covers 5 to 10 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the low precipitation.
This unit has a slight to moderate limitation for fencing due to the sandy textures of the Yellowrock soil.
Range site name: Arid loam 4-6" p.z. (CA-29-45)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the possibility of flash flooding and dustiness. This unit has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many sandy textures and slightly sodic lower layers in some areas. Cutbanks are not stable and are subject to slumping. Sulfate-resistant concrete should be used in any construction project.

Interpretive Groups:
This mapping unit is in capability unit IIIs-6(30), irrigated, and subclass VIIe(30), nonirrigated. This unit is moderately well suited for irrigated agriculture. It is limited by some sandy textures and low available water capacities, low acreage, and some slightly sodic lower layers in some areas.

173 - Yermo extremely gravelly sandy loam, 2 to 5 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents

Setting:
This very deep, well drained soil is on gently sloping alluvial fans near Keeler. It formed in gravelly alluvium derived dominantly from metasedimentary and metavolcanic rock sources. The native vegetation is mainly salt and sodium-tolerant desert shrubs. Elevation is 3,600 to 4,100 feet. The mean annual precipitation is about 4 inches, the mean annual air temperature is about 59°F, and the mean 32° frost-free season is about 225 days. Mean annual snowfall is less than 2 inches. There is a rare hazard of flash flooding in summer.

Typical Profile:
Typically, the soil surface is covered with about 75 percent angular gravel and 15 percent angular cobbles. The soil is light gray extremely gravelly sandy loam to a depth of 60 inches or more. The soil contains about 65 percent angular rock fragments consisting of about 55 percent gravel, 10 percent cobbles, and a trace of stones. In some areas the surface layer is very gravelly sandy loam.

Inclusions:
Included in this unit are small areas of saline-sodic Yermo soils with a 6 to 30-inch overburden of windblown sand (north of Keeler), Seaman soils, Halloran Variant soils, and other soils that are not saline-sodic. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Yermo soil is moderately rapid (2-6 in/hr). The available water capacity is very low to low (1.0-3.5 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is very strongly alkaline (pH 9.0-10.5). The electrical conductivity of the saturation extract is 8 to 30 mmhos/cm (below the surface layer), and the exchangeable sodium percentage is 30 to 95. The soil contains up to 120 ppm of boron. The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under both native and bare soil conditions. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry. During windy weather this unit receives saline dust and sand from the nearby dry Owens Lake.

Use:
At present, this unit is used for gravel extraction and wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

allscale saltbush (*Atriplex polycarpa*)	60%
Mojave seablite (*Sueda torreyana*)	15%
shadscale (*Atriplex confertifolia*)	10%
Parry saltbush (*Atriplex parryi*)	5%

The annual production of air-dry vegetation ranges from 25 to 50 pounds per acre. Vegetation covers less than 5 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and saline-sodic condition. This unit has a severe limitation for fencing due to the many rock fragments.
Range site name: Alkali arid loam 4-6 p.z. (CA-29-46)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are many rock fragments, dustiness, and the high content of salts and exchangeable sodium. The soil has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the high

content of rock fragments, salts, and exchangeable sodium. Excavations are impeded by the many rock fragments. Sulfate-resistant concrete should be used in any construction project. Roads should be designed to control surface runoff and avoid excess rilling.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments, high boron content, and saline-sodic condition.

174 - Yermo association, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents

Setting:
This mapping unit is on alluvial fans in Owens Valley. Most of these fans are joined together into a long bajada and are incised with shallow drainageways and a few steep-sided drainageways. Stringers of stones radiate down the fans from the mouths of canyons. The native vegetation is mainly desert shrubs with some perennial grasses and annual forbs. Elevation is 3,600 to 4,400 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 57 to 60°F, and the mean 32° frost-free season is 190 to 225 days. Mean annual snowfall is less than 2 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 60 percent Yermo extremely gravelly sandy loam and 20 percent Yermo stony sandy loam. Yermo extremely gravelly sandy loam is on the lower and middle parts of the alluvial fans with slopes of 5 to 10 percent, and Yermo stony sandy loam is on the higher parts of the fans with slopes of 10 to 15 percent, near the mouths of canyons.

Inclusions:
Included in this unit are small areas of bouldery Arizo soils, Seaman soils, saline-sodic Yermo soils, soils with slopes of less than 5 or more than 15 percent, Millner soils at the higher elevations, Yermo soils with very gravelly silt loam textures, and areas of rubbleland near the mouths of canyons. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Yermo extremely gravelly soil is very deep and well drained. It formed in gravelly alluvium derived dominantly from metasedimentary and metavolcanic rock sources. Typically, the soil is covered with about 85 percent angular rock fragments consisting of about 80 percent gravel and 5 percent cobbles. The surface layer is light brownish gray extremely gravelly sandy loam about 1 inch thick. The next layer is light brownish gray very gravelly sandy loam about 3 inches thick. The next layer to a depth of 60 inches or more is light gray very gravelly and extremely gravelly sandy loam. The soil contains an average of about 50 percent angular rock fragments consisting of about 35 percent gravel, 15 percent cobbles, and a trace of stones. In some areas the surface layer is very gravelly sandy loam.

The Yermo stony soil is very deep and well drained. It formed in stony and gravelly alluvium derived dominantly from metasedimentary and metavolcanic rock sources. Typically, the soil surface is covered with about 85 percent angular rock fragments consisting of about 75 percent gravel, 5 percent cobbles, and 3 percent stones. The surface layer is light brownish gray stony sandy loam about 4 inches thick. The next layer to a depth of 60 inches or more is light gray very gravelly and very cobbly sandy loam. The soil contains about 55 percent angular rock fragments consisting of about 35 percent gravel, 15 percent cobbles, and 3 percent stones. In some areas the surface layer is extremely cobbly sandy loam.

Properties:
Permeability of the Yermo extremely gravelly soil is moderately rapid (2-6 in/hr). The available water capacity is very low to low (2.0-4.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous and is moderately to strongly alkaline (pH 7.8-9.0). The electrical conductivity of the saturation extract is 2 to 8 mmhos/cm (in the lower layer), and the exchangeable sodium percentage is 10 to 20 percent below a depth of about 24 inches. The soil contains 2 to 10 ppm of boron. The surface foot of soil is relatively free of salt, boron, and exchangeable sodium, but their content increases with depth. The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur on compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. However, the soil is very dusty if disturbed when dry.

Permeability of the Yermo stony soil is moderately rapid (2-6 in/hr). The available water capacity is very low to low (2.0-4.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to strongly alkaline (pH 7.8-9.0). The electrical conductivity of the saturation extract is 2 to 8 mmhos/cm (in the lower layer), and the exchangeable sodium percentage is 10 to 20 percent below a depth of about 24 inches. The soil contains 2 to 10 ppm of boron. The surface foot of soil is relatively free of salt, boron, and exchangeable sodium, but their content increases with depth. The organic carbon is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur on compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty if disturbed when dry.

Use:
At present, this unit used for wildlife habitat.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

creosotebush (*Larrea divaricata*)	20%
shadscale (*Atriplex confertifolia*)	15%
white bursage (*Ambrosia dumosa*)	10%
allscale saltbush (*Atriplex polycarpa*)	10%
white burrobush (*Hymenoclea salsola*)	10%

desert needlegrass (Stipa speciosa)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
desert peach (Prunus andersonii)	5%
bud sagebrush (Artemisia spinescens)	5%
annual forbs	5%
desert trumpet (Eriogonum inflatum)	1%
beavertail pricklypear(Opuntia basilaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and many rock fragments. This unit has a moderate to severe limitation for fencing due to the many rock fragments.
Range site name: Creosote bush gravelly loam 4-6" p.z.(CA-29-40)

Plate 37. An overhead view of the surface pavement on the Yermo soils in units 174 and 177. The angular gravel averages about one inch in diameter.

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments, possible flash flooding, and dustiness. The soil has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many rock fragments. Excavations are impeded by the many rock fragments. Sulfate-resistant concrete should be used in any construction project. Roads should be designed to control surface runoff and avoid excessive rilling.

Interpretive Groups:
The Yermo extremely gravelly soil and the Yermo stony soil are both in capability subclass VIIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments.

175 - Zono coarse sand, 15 to 50 percent slopes

Taxonomic Class:
Ashy over loamy, mixed, nonacid, mesic Xeric Torriorthents

Setting:
This deep, somewhat excessively drained soil is on hills southeast of Mono Lake. It formed in rhyolitic volcanic ash that was showered over material weathered in place from dacitic, basaltic, or granitic bedrock. The topography is hilly to steep. The native vegetation is mainly cool desert shrubs, perennial grasses, and annual forbs. Elevation is 6,800 to 8,000 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature is 42 to 46°F, and the mean 32° frost-free season is 100 to 125 days. A one to two-foot mantle of snow may cover this unit in winter for extended periods. Mean annual snowfall is 55 to 85 inches. Some thundershowers occur in summer, but they are infrequent and of limited extent.

Typical Profile:
Typically, the surface layer is light brownish gray coarse sand about 3 inches thick. This layer has loose consistency. The next layer is light gray loamy sand about 21 inches thick. The next layer is light brownish gray gravelly sand about 6 inches thick. The next layer is pale brown very cobbly sand about 4 inches thick. The next layer is light yellowish brown gravelly sandy loam about 7 inches thick. Weathered bedrock is at a depth of 41 inches in this typical profile, but can range from 40 to 60 inches deep. The ashy overburden (upper 2 to 3 feet of soil) contains an average of about 10 percent pumice gravel. The lower layers contain an average of about 30 percent rock fragments (granite, dacite, or basalt) consisting of about 15 percent gravel, 10 percent cobbles, and 5 percent stones. In some areas the surface layer is loamy sand.

Inclusions:
Included with this unit are small areas of soils similar to the Zono soil with bedrock at depths of 20 to 40 inches or at depths greater than 60 inches, Cowtrack soils at the higher elevations, rock outcrops and shallow soils near hilltops, Brantel soils in some drainageways, and soils with slopes of less than 15 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Properties:
Permeability of this Zono soil is rapid (6-20 in/hr). The available water capacity is low to moderate (4.5-6.0 in). Effective rooting depth is 40 to 60 inches. Many roots enter cracks in the bedrock and can tap deeply percolating water. The soil is noncalcareous and is slightly acid to neutral (pH 6.4-7.0). The organic carbon content is 0.2 to 0.4 percent. Runoff is very slow. The water erosion condition class is estimated as stable under

both native and bare soil conditions. However, the soil is very susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under native conditions and moderate under bare soil conditions.

Use:
At present, this unit is used for grazing and wildlife habitat.

Plate 38. Typical landscape of unit 175 in the Cowtrack Mountain area, southeast edge of Mono Basin. Looking south toward the Sierra Nevada.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

mountain big sagebrush (Artemisia tridentata)	20%
Indian ricegrass (Oryzopsis hymenoides)	20%
antelope bitterbrush (Purshia tridentata)	20%
perennial forbs	10%
needle and thread grass (Stipa comata)	5%
western needlegrass (Stipa occidentalis)	5%
Douglas rabbitbrush (Chrysothamnus viscidiflorus)	3%
green Mormon tea (Ephedra viridis)	2%
basin wildrye (Elymus cinereus)	2%
blue wildrye (Elymus glaucus)	2%
sulfur buckwheat (Eriogonum umbellatum polyanthum)	2%
common pricklygilia (Leptodactylon pungens)	2%

The annual production of air-dry vegetation ranges from 500 to 900 pounds per acre. Vegetation covers 30 to 40 percent of the soil surface. This unit is

poorly to very poorly suited to rangeland seeding due to many steep slopes and sandy textures. This unit has a severe limitation for fencing due to the loose, sandy textures.
Range site name: Ashy loamy sand 10-14" p.z. (CA-26-35)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the loose, sandy surface layer and steep slopes. Off-pavement vehicle travel requires 4-wheel drive. The soil has low susceptibility to surface scarring by off-road vehicles. The soil is more trafficable when it is wet than when dry.

Engineering Limitations:
If this unit is used for building sites, the main limitations are many steep slopes, sandy textures, and bedrock at depths of 40 to 60 inches. Buildings and roads should be designed to offset the limited ability of this soil to support a load. The possibility of settlement can be minimized by compacting the site before construction begins. Cuts needed to provide essentially level building sites can expose bedrock. Roads should be designed to control surface runoff and avoid excess rilling.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(26), nonirrigated. This unit is very poorly suited to irrigated agriculture due to the many steep slopes, sandy textures, and short growing season.

176 - Honova Variant - Rock outcrop complex, 2 to 9 percent slopes

Taxonomic Class:
Mixed, thermic, shallow Xeric Torripsamments (Honova Variant)

Setting:
This mapping unit is on pediments around the Alabama Hills, in Owens Valley. The topography is undulating to gently rolling. The native vegetation is mainly mixed desert shrubs, perennial grasses, and annual forbs. Elevation is 4,800 to 5,200 feet. The mean annual precipitation is about 6 inches, the mean annual air temperature is about 55°F, and the mean 32° frost-free season is about 200 days. Mean annual snowfall is 5 to 15 inches.

Percentages:
This unit is 40 percent Honova Variant soil and 40 percent rock outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of shallow and moderately deep soils with sandy clay loam subsoils (Xeralfic Haplargids), rock outcrops, Thibau soils in drainageways, and soils with slopes of less than 2 or more than 9 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Honova Variant soil is shallow or very shallow, somewhat excessively

drained. It formed in material weathered in place from granitic rock. Typically, the surface layer is pale brown loamy coarse sand about 6 inches thick. Decomposing granitic bedrock is at a depth of 6 inches in this typical profile, but can range from 5 to 20 inches deep. The soil contains about 10 percent fine and medium granitic gravel. A fragile surface layer with vesicular pores is present in some areas.

The rock outcrops cover 0 to 20 percent of the surface area, but the total average coverage is about 5 percent. They project 5 to 50 feet above the soil surface.

Properties:
Permeability of the Honova Variant soil is rapid (6-20 in/hr) above the decomposing bedrock. The available water capacity is very low (0.4-1.5 in). Effective rooting depth is 5 to 20 inches. Some roots enter cracks in the bedrock and can tap deeply percolating water. The soil is calcareous in some areas. The soil reaction is mildly alkaline (pH 7.4-7.8). The organic carbon content is 0.2 to 0.4 percent. Runoff is slow. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions. The soil is susceptible to scour erosion if water is concentrated in a channel, due to the detachability of this noncohesive soil. The hazard of soil blowing is low under both native and bare soil conditions. Any soil loss on shallow soils can significantly reduce their long term productivity.

Use:
At present, this unit is used for grazing, wildlife habitat, and some limited recreation.

Vegetation and Rangeland:
The potential plant community on the Honova Variant soil is mainly:

shadscale (Atriplex confertifolia)	15%
spiny hopsage (Grayia spinosa)	10%
desert needlegrass (Stipa speciosa)	10%
bud sagebrush (Artemisia spinescens)	10%
Nevada ephedra (Ephedra nevadensis)	10%
white burrobush (Hymenoclea salsola)	10%
common winterfat (Eurotia lanata)	5%
Cooper goldenbush (Haplopappus cooperi)	5%
allscale saltbush (Atriplex polycarpa)	5%
longspine horsebrush (Tetradymia axillaris)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
Anderson wolfberry (Prunus andersonii)	2%
white bursage (Franseria dumosa)	2%

The annual production of air-dry vegetation is 100 to 200 pounds per acre. Vegetation covers 10 to 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to low precipitation, sandy textures, and shallow soil depth. This unit has a severe limitation for fencing due to the many rock outcrops and shallow soil depth.
Range site name: Stony alluvial fan 6-8" p.z. (CA-29-32)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock outcrops, sandy texture and shallow soil depth. This unit has moderate susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are the many rock outcrops and shallow soil depth. Cuts needed to provide essentially level building sites can expose bedrock. This unit has a severe limitation for conventional septic tank systems.

Interpretive Groups:
This mapping unit is in capability subclass VIIe(29), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock outcrops, shallow soil depth, and uneven topography.

177 - Yermo association, cool, 5 to 15 percent slopes

Taxonomic Class:
Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents

Setting:
This mapping unit is on alluvial fans in Owens Valley. Most of these fans are joined together into a long bajada and are incised with shallow drainageways and a few steep-sided drainageways. Stringers of stones radiate down the fans from the mouths of canyons. The native vegetation is mainly desert shrubs with some perennial grasses and annual forbs. Elevation is 3,800 to 4,400 feet. The mean annual precipitation is 4 to 6 inches, the mean annual air temperature is 55 to 57°F, and the mean 32° frost-free season is 170 to 200 days. Mean annual snowfall is about 5 inches. There is a rare hazard of flash flooding in summer.

Percentages:
This unit is 60 percent Yermo extremely gravelly sandy loam and 20 percent Yermo stony sandy loam. Yermo extremely gravelly sandy loam is on the lower and middle parts of the alluvial fans with slopes of 5 to 10 percent, and Yermo stony sandy loam is on the higher parts of the fans with slopes of 10 to 15 percent, near the mouths of canyons.

Inclusions:
Included in this unit are small areas of bouldery Arizo soils, Seaman soils, saline-sodic Yermo soils, soils with slopes of less than 5 or more than 15 percent, Millner soils at the higher elevations, Yermo soils with very gravelly silt loam textures, and areas of rubbleland near the mouths of canyons. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Yermo extremely gravelly soil is very deep and well drained. It formed in gravelly alluvium derived donimantly from metasedimentary and metavolcanic rock sources. Typically, the soil is covered with about 85 percent angular rock fragments consisting of about 80 percent gravel and 5 percent cobbles. The surface layer is light brownish gray extremely gravelly sandy loam about

1 inch thick. The next layer is light brownish gray very gravelly sandy loam about 3 inches thick. The next layer to a depth of 60 inches or more is light gray very gravelly and extremely gravelly sandy loam. The soil contains an average of about 50 percent angular rock fragments consisting of about 35 percent gravel, 15 percent cobbles, and a trace of stones. In some areas the surface layer is very gravelly sandy loam.

The Yermo stony soil is very deep and well drained. It formed in stony and gravelly alluvium derived dominantly from metasedimentary and metavolcanic rock sources. Typically, the soil surface is covered with about 85 percent angular rock fragments consisting of about 75 percent gravel, 5 percent cobbles, and 3 percent stones. The surface layer is light brownish gray stony sandy loam about 4 inches thick. The next layer to a depth of 60 inches or more is light gray very gravelly and very cobbly sandy loam. The soil contains about 55 percent angular rock fragments consisting of about 35 percent gravel, 15 percent cobbles, and 3 percent stones. In some areas the surface layer is extremely cobbly sandy loam.

Properties:
Permeability of the Yermo extremely gravelly soil is moderately rapid (2-6 in/hr). The available water capacity is very low to low (2.0-4.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to strongly alkaline (pH 7.8-9.0). The electrical conductivity of the saturation extract is 2 to 8 mmhos/cm (in the lower layer), and the exchangeable sodium percentage is 10 to 20 percent below a depth of about 24 inches. The soil contains 2 to 10 ppm of boron. The surface foot of soil is relatively free of salt, boron, and exchangeable sodium, but their content increases with depth. The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. Some rilling may occur in compacted areas. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty if disturbed when dry.

Permeability of the Yermo stony soil is moderately rapid (2-6 in/hr). The available water capacity is very low to low (2.0-4.0 in). Effective rooting depth is 60 inches or more. The soil is calcareous throughout the profile. The soil reaction is moderately to strongly alkaline (pH 7.8-9.0). The electrical conductivity of the saturation extract is 2 to 8 mmhos/cm (in the lower layer), and the exchangeable sodium percentage is 10 to 20 percent below a depth of about 24 inches. The soil contains 2 to 10 ppm of boron. The surface foot of soil is relatively free of salt, boron, and exchangeable sodium, but their content increases with depth. The organic carbon is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and slight under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty if disturbed when dry.

Use:
At present, this unit used for wildlife habitat and grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (Atriplex confertifolia)	25%
white bursage (Ambrosia dumosa)	25%
allscale saltbush (Atriplex polycarpa)	15%
white burrobush (Hymenoclea salsola)	15%
desert needlegrass (Stipa speciosa)	10%
Indian ricegrass (Oryzopsis hymenoides)	5%
desert peach (Prunus andersonii)	5%
bud sagebrush (Artemisia spinescens)	5%
annual forbs	5%
desert trumpet (Eriogonum inflatum)	1%
beavertail pricklypear (Opuntia basilaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited to rangeland seeding due to the low precipitation and many rock fragments. This unit has a moderate to severe limitation for fencing due to the many rock fragments.
Range site name: Shadscale gravelly loam 4-6" p.z. (CA-29-39)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are the many rock fragments, possible flash flooding, and dustiness. The soil has high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitation is the many rock fragments. Excavations are impeded by the many rock fragments. Sulfate-resistant concrete should be used in any construction project. Roads should be designed to control surface runoff and avoid excessive rilling.

Interpretive Groups:
The Yermo extremely gravelly soil and the Yermo stony soil are both in capability subclass VIIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the many rock fragments.

178 - Entic Durorthids - Typic Durorthids complex, warm, 5 to 50 percent slopes

Taxonomic Class:
Entic Durorthids
Typic Durorthids

Setting:
This mapping unit is on remnants of dissected fan terraces at the base of the Inyo Mountains in Owens Valley. The topography is gently rolling to steep. The native vegetation is mainly desert shrubs, perennial grasses, and annual forbs. Elevation is 3,900 to 4,500 feet. The mean annual precipitation is 4 to 6 inches, mean annual air temperature is 57 to 59°F, and the mean 32°frost-

free season is about 200 days. Mean annual snowfall is less than 2 inches. The mean annual soil temperature is 62 to 65°F.

Percentages:
This unit is 60 percent Entic Durorthids and 20 percent Typic Durorthids. The Entic Durorthids are mainly on sideslopes and the Typic Durorthids are mainly on the ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Inclusions:
Included in this unit are small areas of Yermo soils, shallow soils over hard bedrock (Lithic Torriorthents), badland, soils similar to the Entic and Typic Durorthids but with slightly more rainfall and a slightly different plant community (Haploxerollic and Xerollic Durorthids), and soils with slopes of less than 5 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Typical Profile:
The Entic Durorthids are shallow to moderately deep and are well drained. They formed in gravelly alluvium from mixed rock sources. The soil surface is covered with 50 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is gravelly sandy loam about 3 inches thick. It is a fragile layer with vesicular pores. The next layer is very gravelly sandy loam and stratified weak, platy hardpan. The underlying material is extremely gravelly sandy loam and loamy sand. The soil above the hardpan contains an average of 25 to 60 percent rock fragments consisting of angular gravel and angular cobbles. Depth to the hardpan ranges from 10 to 40 inches. In some areas the surface layer is cobbly sandy loam.

The Typic Durorthids are shallow or very shallow and are well drained. They formed in gravelly alluvium from mixed rock sources. The soil surface is covered with 50 to 80 percent angular gravel and cobbles. The surface layer is very gravelly or extremely gravelly sandy loam about 1 inch thick. The next layer is sandy loam or gravelly sandy loam about 4 inches thick. It is a fragile layer with vesicular pores. The next layer is a very hard, continuous hardpan that is estimated to be about 1 foot thick. The underlying material is estimated as very gravelly or extremely gravelly, sandy loam or loamy sand. The soil above the hardpan contains an average of 15 to 60 percent rock fragments consisting of angular gravel and angular cobbles. Depth to the hardpan ranges from 4 to 20 inches. In some areas the surface layer is cobbly sandy loam.

Properties:
Permeability of the Entic Durorthids is moderately rapid (2-6 in/hr). The available water capacity is very low to low (0.8-3.0 in.) Effective rooting depth is 10 to 40 inches. Some roots penetrate the discontinuous hardpan through cracks and lenses of very gravelly sandy loam. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty is disturbed when it is dry.

Permeability of the Typic Durorthids is moderately rapid (2-6 in/hr) to a depth of about 4 inches and very slow (less than 0.06 in/hr) through the hardpan. The permeability is estimated as moderately rapid to rapid (2.0-20 in/hr) below the hardpan. The available water capacity is very low (0.3-1.5 in.). Effective rooting depth is 4 to 20 inches. The soil is calcareous throughout the profile and is moderately alkaline (pH 7.9-8.4). The organic carbon content is less than 0.2 percent. Runoff is medium. The water erosion condition class is estimated as stable under native conditions and moderate under bare soil conditions where the surface pavement is removed. The hazard of soil blowing is low under both native and bare soil conditions. The soil is very dusty if disturbed when is dry.

Use:
At present, this unit is used for wildlife habitat, recreation, and grazing.

Vegetation and Rangeland:
The potential plant community on this unit is mainly:

shadscale (Atriplex confertifolia)	25%
creosotebush (Larrea divaricata)	15%
allscale saltbush (Atriplex polycarpa)	10%
desert needlegrass (Stipa speciosa)	10%
white burrobush (Hymenoclea salsola)	5%
Indian ricegrass (Oryzopsis hymenoides)	5%
white bursage (Ambrosia dumosa)	5%
annual forbs	3%
Nevada ephedra (Ephedra nevadensis)	3%
Fremont dalea (Dalea fremontii)	2%
desert trumpet (Eriogonum inflatum)	1%
bud sagebrush (Artemisia spinescens)	T
beavertail pricklypear (Opuntia basillaris)	T
staghorn cholla (Opuntia echinocarpa)	T

The annual production of air-dry vegetation ranges from 100 to 300 pounds per acre. Vegetation covers 5 to 15 percent of the soil surface. This unit is very poorly suited for rangeland seeding due to the low precipitation, many shallow soils, and uneven topography. This unit has a moderate to severe limitation for fencing due to the hardpan and many rock fragments.
Range site name: Creosotebush gravelly loam 4-6" p.z. (CA-29-40)

Recreational Development:
If this unit is used for recreational purposes, the main limitations are some steep slopes, many rock fragments, and dustiness. Although the topography of this unit is well suited for off-road vehicle recreation, the soils have a high susceptibility to surface scarring by off-road vehicles.

Engineering Limitations:
If this unit is used for building sites, the main limitations are some steep slopes, many rock fragments, and hardpans. Excavations may be impeded by the hardpan. Absorption lines for septic tank absorption fields should be placed below the hardpan. Dirt roads should be designed to control surface runoff.

Interpretive Groups:
This mapping unit is in capability subclass VIIs(30), nonirrigated. This unit is very poorly suited for irrigated agriculture due to the hardpan, uneven topography, and many rock fragments.

USE AND MANAGEMENT OF THE SOILS

USE AND MANAGEMENT OF THE SOILS

The soil inventory is an analysis and evaluation of the most basic resource of the area--the soil. It may be used to fit the use of the land to the limitations and potentials of the natural resources and the environment, and to help avoid soil-related failures in uses of the land.

During a soil inventory soil scientists, range conservationists, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, rangeland yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plans and decisions for use and management of soils for range, woodland, and many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in structures, because of unfavorable soil properties, may be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations.

Planners and others using the soil inventory can evaluate the impact of specific land uses on the overall productivity of the area or other broad planning areas, and on the environment. Both of these factors are closely related to the nature of the soil. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil inventory. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, campsites, cemeteries, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

RATING SOILS FOR SELECTED USES

Soils are rated for the uses expected to be important or potentially important to users of soil inventory information. Ratings for proposed uses are given in terms of limitations and restrictive features, suitability and restrictive features, or only restrictive features. Only the most restrictive features are listed, therefore, a soil rated severe gives those soil features that cause the soil to be rated severe. There may be other features that need to be treated to overcome soil limitations for a specific purpose. The definition of the ratings are as follows:

Limitation Ratings

Soils are rated in their "natural" state, that is, no unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Only the most restrictive features are listed.

Slight is the rating given soils that have properties favorable for the use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.

Moderate is the rating given soils that have properties moderately favorable for the use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance of the structure or other planned use is somewhat less desirable than for soils rated slight. Some soils rated moderate require treatment such as artificial drainage, control of runoff to reduce erosion, extended septic tank absorption fields, extra excavation, or some modification of certain features through manipulation of the soil. For these soils, modification is needed for those construction plans generally used for soils of slight limitation. Modification may include specially designed foundations, extra reinforcement of structures, sump pumps, and the like.

Severe is the rating given soils that have one or more properties unfavorable for the rated use, such as steep slopes, bedrock near the surface, flooding, high shrink-swell potential, a seasonal high water table, or low strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some of these soils, however, can be improved by reducing or removing the soil feature that limits use, but in most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for a severe degree of limitation.

A soil rated very severe has one or more features so unfavorable for the rated use that the limitation is very difficult and expensive to overcome. Reclamation would be extremely difficult, requiring the soil material to be removed, replaced, or completely modified. Very shallow soils over hard rock or deep, wet organic soils, for example, have very severe limitations for houses with basements or for onsite sewage disposal. A rating of very severe should be confined to soils that require extreme alteration and that, for the most part, are not used for the purposes being rated.

In rating soils for nonfarm uses, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most degrees of limitations. Most of these practices, however, are costly. The owner must be willing to live with a few limitations, providing the use does not violate community codes or regulations. The final decision in selecting a site for a particular use is a personal one and generally involves weighing the costs for site preparation and maintenance.

Suitability Ratings

Soils are rated in their "natural" state, that is, no unusual modifications of the soil site or materials are made other than that which is normal practice for the rated use. A rating of good means the soils have properties favorable for the use. Good performance and low maintenance can be expected.

A rating of fair means the soil is moderately favorable for the use. One or more soil properties make these soils less desirable than those rated good.

A rating of poor means the soil has one or more properties unfavorable for the use. Overcoming the unfavorable property requires special design, extra maintenance, or costly alteration.

A rating of unsuited means the expected performance of the soil would be unacceptable for the use, or extreme measures are needed to overcome the undesirable features.

RECREATIONAL DEVELOPMENT

Soils are rated in Table A according to limitations that affect their suitability for camp areas, paths and trails, and for off-road vehicle (ORV) use. Not considered in this rating, but important in evaluating a site, are location, accessibility of the area, size and shape of the area, and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public service lines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of duration and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively for tents, trailers, and campers, and the accompanying activities of outdoor living. Camp areas require such site preparation as shaping and leveling, areas for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camping areas and the performance of the camping area after development. Soil properties that influence trafficability and promote the growth of vegetation after heavy use are important.

Slope, stoniness, and depth to bedrock or cemented pan are the main concerns in developing camp areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm to heavy foot traffic, and not be dusty when dry. Soil properties that influence trafficability are texture of the surface layer, wetness, permeability, and large stones. Slow permeability and clayey surface texture are not as severe a limitation in dry regions of the country, however, silty soils may be more of a problem because they are dusty. Soil properties that influence the growth of plants are depth to bedrock or cemented pan, permeability, and presence of toxic materials. Soils that flood are particularly hazardous for camp areas because of the danger to life and property.

Paths and trails are used for walking, horseback riding, and other uses and require little or no cutting or filling. The soils are rated on the properties that influence trafficability and erodibility. These are stoniness, wetness, texture of the surface layer, slope, flooding, erodibility, and in dry regions, dustiness.

Off-road vehicle (ORV) use considers soil features impacted by use of motorcycles, dune buggies, four-wheel drive trucks, etc. The ratings assume repeated use of the soils by ORVs. Hazards to the vehicle or operator (such as surface rock fragments), and access difficulties are not considered in the ratings. The major soil properties or qualities impacted by ORV use are increased erosion and soil compaction. Soils are rated on their water erosion hazard, wind erosion hazard, and soil strength. Some soils in the area are easily scarred by vehicle traffic and are footnoted as such. Under natural conditions, most soils in the inventory area have such high infiltration rates that no runoff is produced, except during the most intense storms. Rainfall rates of 1½ to 2½ in/hr are required to generate runoff on initially dry soils. Therefore, significant water erosion is very infrequent, occurring only several times each century. ORV use on soils in the area compacts the soil, degrades vegetation, and breaks any surface crust or desert pavement (concentration of rock fragments) that is present. These predispose the soil to accelerated wind or water erosion when rainfall of sufficient intensity occurs. In the Benton-Owens Valley area, intensities of .35-.50 in/hr can be expected to occur about once every two years, and intensities of 1.1-1.5 in/hr can be expected about once every 100 years. These intensities are usually associated with thunderstorm activity.

TABLE A -- RECREATIONAL DEVELOPMENT

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
101			
Alamedawell	Severe: too sandy	Severe: too sandy	Severe: soil blowing
Deepwell	Severe: too sandy	Severe: too sandy	Severe: soil blowing
102			
Aquents	Severe: ponding, wetness *too sandy excess sodium *excess salt	Severe: ponding, wetness	Severe: low strength
Aquic Torriorthents . .	Severe: *too sandy *excess sodium *excess salt	Severe: *too sandy *too dusty	Moderate to Severe:[2] soil blowing low strength
103			
Aquents	Severe: ponding, wetness *too sandy excess sodium *excess salt	Severe: ponding, wetness	Severe: low strength
Aquic Torriorthents . .	Severe: *too sandy *excess sodium *excess salt	Severe: *too sandy *too dusty	Moderate to Severe:[2] soil blowing low strength
Deepwell	Severe: too sandy	Severe: too sandy	Severe: soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
104 Arizo	Severe: *slope large stones too sandy	Moderate to Severe: large stones too sandy	Moderate: erodes easily
105 Arizo	Moderate: *slope large stones too sandy	Moderate: *large stones too sandy	Moderate: erodes easily
Yellowrock.	Moderate: *slope too sandy	Moderate: too sandy	Moderate: soil blowing
106 Badland	Severe: slope excess sodium	Severe: slope erodes easily	Severe:2/ erodes easily
107 Washoe.	Severe: slope large stones *percs slowly	Severe: large stones too sandy	Moderate:1/ erodes easily
108 Washoe.	Moderate: large stones *percs slowly slope	Moderate: large stones too sandy	Moderate:1/ erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
108 (cont.)			
Washoe Variant.	Moderate: *too sandy *percs slowly slope	Slight to Moderate: too sandy	Moderate:1/ erodes easily
109			
Berent family	Severe: slope	Severe: slope	Severe: erodes easily
Glenbrook family. . . .	Severe: slope depth to rock	Severe: slope	Severe: erodes easily
110			
Bitter.	Moderate: large stones too sandy *slope *percs slowly	Moderate: *large stones too sandy	Moderate:1/ erodes easily
Garlock Variant	Moderate: *slope percs slowly *too sandy	Slight to Moderate: too sandy	Moderate:1/ erodes easily
111			
Brantel	Severe: too sandy	Severe: too sandy	Severe: soil blowing
112			
Brántel	Severe: too sandy	Severe: too sandy	Severe: soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
113			
Brantel Variant	Severe: too sandy	Severe: too sandy	Severe: soil blowing
Brantel	Severe: too sandy	Severe: too sandy	Severe: soil blowing
114			
Buscones.	Severe: too sandy	Severe: too sandy	Severe: erodes easily
115			
Cajon	Moderate: too sandy	Moderate: too sandy	Moderate: soil blowing
116			
Cashbaugh	Severe: depth to rock	Slight	Severe: soil blowing
Buscones.	Slight	Slight	Severe: soil blowing
117			
Cashbaugh	Severe: depth to rock too sandy	Severe: too sandy	Severe: erodes easily soil blowing
Brantel	Severe: too sandy	Severe: too sandy	Severe: soil blowing
118			
Chidago	Severe: too sandy	Severe: too sandy	Severe: soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
119 Cowtrack.	Severe: too sandy *slope	Severe: too sandy	Severe: *erodes easily soil blowing
120 Cowtrack Variant. . . .	Severe: too sandy	Severe: too sandy	Severe: soil blowing
121 Cryoborolls	Severe: slope small stones *depth to rock	Slopes 15 to 25 percent Moderate: slope Slopes 25 to 50 percent Severe: slope	Severe:[2] erodes easily
122 Cryoborolls	Severe: slope *depth to rock	Slopes 15 to 25 percent Moderate: *large stones too sandy slope Slopes 25 to 50 percent Severe: slope	Severe: erodes easily
123 Durargids, shallow. . .	Severe: percs slowly cemented pan	Slight	Severe:[2] erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
124 Entic Durorthids. . . .	Moderate to Severe: slope small stones cemented pan	Slopes 5 to 25 percent Moderate: slope Slopes 25 to 50 percent Severe: slope	Slopes 5 to 15 percent Moderate:1, 2/ erodes easily Slopes 15 to 50 percent Severe:2/ erodes easily
Typic Durorthids. . . .	Severe: cemented pan	Moderate: slope	Severe:2/ erodes easily
125 Pajuela	Severe: *slope large stones too sandy	Severe: large stones too sandy	Moderate: erodes easily
126 Pajuela	Moderate: large stones too sandy *slope	Moderate: *large stones too sandy	Moderate: erodes easily
Thibau.	Moderate: too sandy *slope	Moderate: too sandy	Moderate: erodes easily soil blowing
127 Halloran Variant. . . .	Severe: excess sodium *excess salt	Slight	Moderate:1, 2/ soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
128 Hammil.	Severe: too sandy	Slight to Moderate: too sandy	Severe: soil blowing
129 Haplargids, frigid. . .	Severe: slope *small stones	Slopes 15 to 25 percent Moderate: slope *dusty Slopes 25 to 50 percent Severe: slope	Severe:2/ erodes easily
Torriorthents, frigid .	Severe: slope *small stones	Slopes 15 to 25 percent Moderate: slope dusty Slopes 25 to 50 percent Severe: slope	Severe:2/ erodes easily
130 Honova.	Severe: *large stones depth to rock	Moderate: large stones	Moderate:1, 2/ erodes easily
131 Honova Variant.	Severe: depth to rock	Moderate: too sandy	Severe: erodes easily
132 Hoye Variant.	Moderate: percs slowly dusty	Moderate: dusty	Moderate:1, 2/ soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
133 Wellington.	Severe: cemented pan	Slight	Moderate: erodes easily
134 Wellington.	Severe: cemented pan	Slight	Moderate: erodes easily
135 Lithic Torriorthents. .	Severe: slope *small stones depth to rock	Severe: slope	Severe:2/ erodes easily
Lithic Haplargids . . .	Severe: slope depth to rock	Severe: slope	Severe:2/ erodes easily
136 Lithic Xerollic Haplargids.	Severe: slope depth to rock	Severe: slope	Severe:2/ erodes easily
Lithic Xeric Torriorthents	Severe: slope *small stones depth to rock	Severe: slope *small stones	Severe:2/ erodes easily
137 Haar family	Severe: depth to rock	Moderate: too sandy	Severe: erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
138 Xeric Torriorthents, very bouldery	Severe: slope	Slopes 15 to 25 percent Moderate: *too sandy slope Slopes 25 to 50 percent Severe: slope	Severe: erodes easily
139 Millner	Moderate to Severe: large stones small stones *slope	Moderate to Severe: small stones	Severe:2/ erodes easily
Millner, stony.	Moderate to Severe: large stones small stones *slope	Moderate to Severe: small stones	Severe:2/ erodes easily
140 Dotard.	Moderate: small stones slope	Moderate to Severe: small stones	Severe:2/ erodes easily
141 Pizona.	Severe: slope	Severe: slope	Severe: erodes easily *soil blowing
Brantel	Severe: too sandy	Severe: too sandy	Severe: soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
142 Avalmount	Moderate to Severe: slope large stones small stones	Moderate: large stones slope	Severe:2/ erodes easily
143 Playa	Severe: excess sodium excess salt *wetness	Slight to Moderate: wetness dusty	Severe:2/ soil blowing *low strength
144 Rock Outcrop.	Severe: slope	Severe: slope	-----------
145 Rovana.	Moderate to Severe: slope too sandy	Moderate to Severe: too sandy	Moderate: erodes easily soil blowing
146 Rovana.	Moderate to Severe: too sandy	Moderate to Severe: too sandy	Severe: soil blowing
147 Sawavu.	Severe: too sandy	Severe: too sandy	Severe: soil blowing
Brantel	Severe: too sandy	Severe: too sandy	Severe: soil blowing
148 Sherwin	Severe: *large stones depth to rock	Moderate: large stones	Severe: erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
149 Taboose	Moderate to Severe: slope large stones small stones	Moderate: large stones	Moderate:1, 2/ erodes easily
150 Taboose	Moderate to Severe: large stones *small stones	Moderate: *large stones dusty	Moderate:1, 2/ erodes easily
151 Thibau.	Moderate to Severe: slope too sandy	Moderate to Severe: too sandy	Moderate: soil blowing
152 Thibau.	Severe: slope *too sandy	Moderate to Severe: too sandy	Moderate: soil blowing
153 Tinemaha.	Severe: slope large stones too sandy	Severe: large stones	Moderate:1/ erodes easily
154 Tinemaha.	Moderate: slope *small stones too sandy	Moderate: *large stones too sandy	Moderate:1/ erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
154 (cont.) Lubkin.	Moderate: slope *too sandy	Slight to Moderate: too sandy	Moderate:1/ erodes easily soil blowing
155 Xeralfic Haplargids, mesic	Moderate to Severe: slope large stones	Moderate to Severe: large stones	Moderate:1/ erodes easily
156 Lithic Xeric Torriorthents	Severe: slope *large stones depth to rock	Severe: slope	Severe:2/ erodes easily
Buscones.	Severe: too sandy slope	Severe: too sandy	Severe: erodes easily
157 Torriorthents, frigid .	Severe: slope *depth to rock	Moderate to Severe: large stones slope	Severe: erodes easily
Haplargids, frigid. . .	Severe: slope *depth to rock	Moderate to Severe: large stones slope	Severe: erodes easily
158 Torripsamments.	Severe: slope too sandy	Severe: too sandy *slope	Severe: erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
158 (cont.) Cinder Land	Severe: slope small stones	Severe: slope small stones	Slight
159 Tuttle.	Severe: slope large stones too sandy	Severe: large stones too sandy	Moderate: erodes easily
160 Tuttle.	Severe: slope large stones too sandy	Severe: large stones too sandy	Moderate: erodes easily
161 Tuttle.	Moderate: slope too sandy	Moderate: *large stones too sandy	Moderate: erodes easily
Rovana.	Moderate: slope too sandy	Moderate: too sandy	Moderate: erodes easily soil blowing
162 Tuttle.	Moderate: slope too sandy	Moderate: *large stones too sandy	Moderate: erodes easily
Rovana.	Moderate: slope too sandy	Moderate: too sandy	Moderate: erodes easily soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
163 Tuttle Variant.	Moderate to Severe: large stones	Slight	Moderate: soil blowing
164 Victorville family. . .	Severe: excess sodium excess salt	Moderate: dusty	Moderate:1, 2/ soil blowing
Villa family.	Severe: too sandy	Severe: too sandy	Severe: soil blowing
165 Water	----------	----------	----------
166 Whitewolf family. . . .	Severe: slope *too sandy	Moderate to Severe: too sandy slope	Severe: erodes easily
Toquerville family. . .	Severe: slope *too sandy depth to rock	Moderate to Severe: too sandy slope	Severe: erodes easily
167 Xeric Torriorthents . .	Slopes 0 to 8 percent Slight Slopes 8 to 15 percent Moderate: slope	Slight	Moderate:1/ erodes easily soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
168			
Xeric Torriorthents, sodic	Severe: excess sodium excess salt	Severe: erodes easily	Severe:[2] erodes easily
169			
Xeric Torriorthents, ashy.	Severe: too sandy	Severe: too sandy	Moderate: soil blowing
Durorthids, ashy. . . .	Severe: too sandy *cemented pan	Severe: too sandy	Moderate: soil blowing
170			
Xerollic Durorthids . .	Moderate to Severe: cemented pan too sandy	Moderate: too sandy	Moderate: erodes easily soil blowing
171			
Yellowrock.	Severe: too sandy excess sodium *excess salt	Severe: too sandy	Slight
172			
Yellowrock.	Slight	Slight	Moderate:[1] soil blowing
Seaman.	Slight	Slight	Moderate:[1] soil blowing

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
173 Yermo	Severe: small stones excess sodium *excess salt	Moderate to Severe: small stones	Slight2/
174 Yermo, extremely gravelly.	Severe: small stones	Moderate to Severe: small stones	Severe:2/ erodes easily
Yermo, stony.	Severe: small stones	Moderate to Severe: small stones	Severe:2/ erodes easily
175 Zono.	Severe: slope too sandy	Severe: *slope too sandy	Severe: erodes easily soil blowing
176 Honova Variant.	Severe: depth to rock	Moderate: too sandy	Severe: erodes easily
177 Yermo, extremely gravelly.	Severe: small stones	Moderate to Severe: small stones	Severe:2/ erodes easily
Yermo, stony.	Severe: small stones	Moderate to Severe: small stones	Severe:2/ erodes easily

TABLE A -- RECREATIONAL DEVELOPMENT (cont.)

Soil Name and Map Symbol	Camp Areas	Paths and Trails	Off-Road Vehicle Use
178 Entic Durorthids. . . .	Moderate to Severe: slope small stones cemented pan	Slopes 5 to 25 percent Moderate: slope Slopes 25 to 50 percent Severe: slope	Slopes 5 to 15 percent Moderate[1, 2] erodes easily Slopes 15 to 50 percent Severe:[2] erodes easily
Typic Durorthids. . . .	Severe: cemented pan	Moderate: slope	Severe:[2] erodes easily

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

1/ Severe when soil moist or wet due to low strength.

2/ Soil surface is easily scarred.

ENGINEERING

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by BLM soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil inventory and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to--(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth 5 or 6 feet. Also, because of the scale of the detailed map in this soil inventory, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table B shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; Table C for sanitary facilities; and Table E, for water management. Table D shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this inventory can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building Site Development

Soil properties influence development of building sites, including the selection of the site, the design of the structure, construction, and after construction, performance and maintenance.

Soil limitation ratings of slight, moderate, and severe are given in Table B for shallow excavations, building sites, and surfaced and unsurfaced roads.

Shallow excavations are trenches or holes dug in the soil to a maximum depth of 5 or 6 feet. They are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, grave sites, and the like. The excavations are most commonly made by trenching machines or backhoes.

The ratings are based on the soil properties that influence ease of digging and the resistance to sloughing. Depth and hardness of bedrock or cemented pan, the bulk density of the soil and the amount of large stones influence the ease of digging, filling, and compacting. Depth to the seasonal high water table and flooding may restrict the time that the excavations can be made. Slope influences the ease of using digging machines. Soil texture and depth to water table influence the resistance to sloughing.

Building sites are buildings of three stories or less without basements. The foundation is assumed to be spread footings of reinforced concrete built on undisturbed soil at a depth of two feet or the depth of maximum frost penetration, whichever is deeper.

The ratings are based on properties affecting soil strength and settlement under a load, and those that affect excavation and construction costs. The properties affecting soil strength and settlement are presence of a high water table and flooding, and the shrink-swell behavior and compressibility of the soils. Compressibility is inferred from the Unified Classification. Properties influencing the ease and amount of excavation are flooding, high water table, slope, depth to bedrock or cemented pan, and the amount of coarse fragments.

Surfaced Road Location. Limitation ratings are given for the use of soils for construction of improved local roads and streets that have all-weather surfacing--commonly of asphalt or concrete--and that are expected to carry automobile traffic all year. The roads and streets consist of (1) the underlying local soil material, whether cut or fill, that is called "the subgrade," (2) the base material, lime-stabilized soil, soil-cement stabilized soil, gravel or crushed rock, and (3) the actual road surface or street pavement that is either flexible (asphalt), rigid (concrete), or gravel with binder in it. These roads and streets are graded to shed water and conventional drainage measures are provided. With probable exception of the hard surface, the roads and streets are built mainly from the soil at hand.

The properties that affect surfaced roads and streets are those that influence the ease of excavation and grading, and traffic supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or cemented pan, depth to water table, flooding, the amount of large stones, and slope. The properties that affect traffic supporting capacity are soil strength as inferred from AASHTO group index and the Unified Classification, shrink-swell behavior, potential frost action, and depth to high water table. Soil slippage may be a problem on certain sloping soils.

Unsurfaced Road Location. Limitation ratings are for the use of soils for planning and locating unsurfaced roads that normally lack surfacing and are expected to carry truck or other automobile traffic when free of snow. The roads consist of the underlying local soil material, or subgrade, and the road surface of compacted local soil material, or gravel. The roads may be graded to shed water. Normally, the roads are constructed from the soil at hand.

TABLE B -- BUILDING SITE DEVELOPMENT

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
101				
Alamedawell	Moderate: cutbanks cave	Slight	Slight	Severe: too sandy
Deepwell	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
102				
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness *low strength	Severe: *low strength wetness
Aquic Torriorthents . .	Moderate: wetness	Moderate: wetness	Slight to Moderate: low strength	Moderate: *low strength wetness *dusty
103				
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness *low strength	Severe: *low strength wetness
Aquic Torriorthents . .	Moderate: wetness	Moderate: wetness	Slight to Moderate: low strength	Moderate: *low strength wetness dusty
Deepwell	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
104				
Arizo	Severe: large stones	Severe: large stones	Severe: large stones	Severe: large stones

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
105				
Arizo	Severe: large stones	Severe: large stones *slope	Severe: large stones	Moderate: large stones *slope
Yellowrock.	Severe: cutbanks cave	Slight to Moderate: *slope *large stones	Slight to Moderate: *slope *large stones	Slight to Moderate: *large stones *slope
106				
Badland	Severe: slope	Severe: slope	Severe: *low strength slope	Severe: *low strength *slope
107				
Washoe.	Severe: large stones	Severe: large stones	Severe: large stones	Severe: *low strength large stones
108				
Washoe.	Severe: large stones slope	Severe: slope large stones	Severe: large stones	Moderate: low strength large stones
Washoe Variant.	Moderate: *large stones slope	Slight to Moderate: slope *large stones	Slight to Moderate: *slope *large stones *low strength	Slight to Moderate: *low strength *slope *large stones
109				
Berent family	Severe: cutbanks cave slope	Severe: slope	Severe: slope	Severe: slope

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
109 (cont.) Glenbrook family. . . .	Severe: depth to rock slope	Severe: slope	Severe: slope	Severe: depth to rock slope
110 Bitter.	Severe: large stones *slope	Severe: *slope large stones	Severe: large stones	Moderate: *low strength large stones
Garlock Variant	Slight to Moderate: *large stones slope	Slight to Moderate: *large stones slope	Slight to Moderate: *large stones *slope	Slight to Moderate: *low strength *slope *large stones
111 Brantel	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
112 Brantel	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
113 Brantel Variant	Severe: cutbanks cave	Slight to Moderate: *slope	Slight to Moderate: *slope	Severe: too sandy
Brantel	Severe: cutbanks cave	Slight to Moderate: *slope	Slight to Moderate: *slope	Severe: too sandy
114 Buscones.	Severe: cutbanks cave	Slight to Moderate: slope	Slight to Moderate: slope	Severe: too sandy

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
115				
Cajon	Severe: cutbanks cave	Slight	Slight	Slight
116				
Cashbaugh	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock
Buscones.	Severe: depth to rock cutbanks cave	Moderate: depth to rock	Moderate: depth to rock	Moderate: depth to rock
117				
Cashbaugh	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock
Brantel	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
118				
Chidago	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
119				
Cowtrack.	Severe: cutbanks cave *slope	Slopes 2 to 15 percent Moderate: slope Slopes 15 to 30 percent Severe: slope	Slopes 2 to 15 percent Moderate: slope Slopes 15 to 30 percent Severe: slope	Severe: too sandy *slope
120				
Cowtrack Variant. . . .	Severe: cutbanks cave	Slight	Slight	Severe: too sandy

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
121 Cryoborolls	Severe: *depth to rock slope	Severe: slope *depth to rock	Severe: *depth to rock slope	Severe: *low strength slope
122 Cryoborolls	Severe: *depth to rock *cutbanks cave *large stones slope	Severe: slope *large stones *depth to rock	Severe: slope *large stones	Moderate to Severe: *depth to rock *low strength *slope *shrink-swell large stones
123 Durargids, shallow. . .	Severe: cemented pan dense layer	Severe: *shrink-swell cemented pan	Severe: cemented pan low strength *shrink-swell	Severe: cemented pan low strength shrink-swell
124 Entic Durorthids. . . .	Severe: cemented pan *slope	Slopes 5 to 15 percent Moderate: slope cemented pan Slopes 15 to 50 percent Severe: slope	Slopes 5 to 15 percent Moderate: slope cemented pan Slopes 15 to 50 percent Severe: slope	Moderate: cemented pan *slope dusty
Typic Durorthids. . . .	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan dusty
125 Pajuela	Severe: cutbanks cave large stones	Severe: large stones	Severe: large stones	Severe: large stones

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
126				
Pajuela	Severe: cutbanks cave *large stones	Severe: large stones *slope	Severe: large stones	Moderate: large stones *slope
Thibau.	Severe: cutbanks cave	Slight to Moderate: slope *large stones	Slight to Moderate: slope *large stones	Slight to Moderate: *large stones *slope
127				
Halloran Variant. . . .	Moderate: dense layer	Slight	Slight	Slight to Moderate: dusty
128				
Hammil.	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
129				
Haplargids, frigid. . .	Severe: *depth to rock slope	Severe: slope *depth to rock	Severe: *depth to rock low strength slope	Severe: *depth to rock low strength
Torriorthents, frigid .	Severe: *depth to rock slope	Severe: slope *depth to rock	Severe: *depth to rock slope	Moderate to Severe: depth to rock *low strength *slope
130				
Honova.	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock
131				
Honova Variant.	Severe: depth to rock	Moderate: depth to rock	Moderate: depth to rock	Moderate: depth to rock

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
132 Hoye Variant.	Slight	Severe: floods	Severe: low strength *shrink-swell	Severe: low strength shrink-swell dusty
133 Wellington.	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan low strength	Severe: cemented pan low strength
134 Wellington.	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan low strength	Severe: cemented pan low strength
135 Lithic Torriorthents. .	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock slope	Severe: depth to rock slope
Lithic Haplargids . . .	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock low strength slope	Severe: depth to rock low strength slope
136 Lithic Xerollic Haplargids.	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock low strength slope	Severe: depth to rock low strength slope

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
136 (cont.) Lithic Xeric Torriorthents	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock slope	Severe: depth to rock slope
137 Haar family	Severe: depth to rock	Moderate: *slope depth to rock	Moderate: depth to rock *slope	Moderate: depth to rock *low strength
138 Xeric Torriorthents, very bouldery	Severe: slope *depth to rock	Severe: slope large stones	Severe: slope *large stones	Severe: slope large stones
139 Millner	Moderate: small stones slope	Moderate: slope small stones	Moderate: slope small stones	Moderate: small stones dusty
Millner, stony.	Moderate: small stones slope	Moderate: slope large stones	Moderate: slope large stones	Moderate: large stones dusty
140 Dotard.	Moderate: small stones slope	Moderate: *slope small stones	Moderate: *slope large stones	Moderate: large stones dusty
141 Pizona.	Severe: depth to rock slope large stones	Moderate to Severe: slope large stones	Severe: *slope *large stones *low strength	Severe: large stones *low strength slope

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
141 (cont.) Brantel	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
142 Avalmount	Severe: large stones *slope	Moderate to Severe: slope large stones	Moderate to Severe: slope large stones	Moderate to Severe: large stones dusty
143 Playa	Moderate to Severe: wetness	Moderate to Severe: wetness	Moderate: *low strength wetness	Severe: wetness *dusty
144 Rock Outcrop.	Severe: depth to rock slope	Severe: slope depth to rock	Severe: slope depth to rock	Severe: depth to rock *slope
145 Rovana.	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Slight
146 Rovana.	Severe: cutbanks cave	Slight	Slight	Moderate to Severe: too sandy
147 Sawavu.	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
Brantel	Severe: cutbanks cave	Slight	Slight	Severe: too sandy

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
148 Sherwin	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock
149 Taboose	Severe: large stones *slope	Slopes 5 to 15 percent Moderate: slope large stones Slopes 15 to 30 percent Severe: slope	Slopes 5 to 15 percent Moderate: slope large stones Slopes 15 to 30 percent Severe: slope	Moderate to Severe: large stones dusty
150 Taboose	Severe: large stones	Moderate to Severe: large stones	Moderate to Severe: large stones	Moderate to Severe: large stones dusty
151 Thibau.	Severe: cutbanks cave	Slight	Slight	Slight
152 Thibau.	Severe: cutbanks cave	Slight	Slight	Moderate to Severe: too sandy *slope
153 Tinemaha.	Severe: large stones	Severe: large stones	Severe: *low strength large stones	Severe: *low strength large stones
154 Tinemaha.	Severe: large stones *slope	Severe: *slope large stones	Severe: *low strength large stones	Moderate: *low strength large stones

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
154 (cont.)				
Lubkin.	Slight to Moderate: slope *large stones	Slight to Moderate: slope *large stones	Slight to Moderate: low strength slope *large stones	Slight to Moderate: *low strength *large stones
155				
Xeralfic Haplargids, mesic	Moderate to Severe: *large stones *slope	Moderate to Severe: slope *large stones	Moderate to Severe: slope *large stones	Severe: slope *large stones
156				
Lithic Xeric Torriorthents	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock slope	Severe: depth to rock *large stones slope
Buscones.	Severe: cutbanks cave	Severe: slope	Severe: slope	Severe: too sandy *slope
157				
Torriorthents, frigid .	Severe: *depth to rock *large stones slope *cutbanks cave	Severe: slope *depth to rock *large stones	Severe: *depth to rock slope *large stones	Severe: *depth to rock large stones slope
Haplargids, frigid. . .	Severe: *depth to rock *large stones slope	Severe: slope *depth to rock *large stones	Severe: *depth to rock *low strength slope *large stones	Severe: *depth to rock *low strength *large stones slope

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
158				
Torripsamments.	Severe: cutbanks cave slope	Severe: slope	Severe: slope	Severe: too sandy *slope
Cinder Land	Severe: slope cutbanks cave	Severe: slope	Severe: slope	Severe: too sandy *slope
159				
Tuttle.	Severe: large stones	Severe: large stones	Severe: large stones	Severe: large stones
160				
Tuttle.	Severe: large stones	Severe: large stones	Severe: large stones	Severe: large stones
161				
Tuttle.	Severe: large stones	Severe: slope large stones	Severe: large stones	Moderate: large stones *slope
Rovana.	Severe: cutbanks cave	Moderate: slope *large stones	Slight to Moderate: slope *large stones	Slight to Moderate: *large stones *slope
162				
Tuttle.	Severe: large stones	Severe: slope large stones	Severe: large stones	Moderate: large stones *slope
Rovana.	Severe: cutbanks cave	Moderate: slope *large stones	Slight to Moderate: slope *large stones	Slight to Moderate: *large stones *slope

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
163 Tuttle Variant.	Severe: cutbanks cave	Slight	Slight	Slight
164 Victorville family. . .	Slight	Slight	Slight	Moderate: dusty
Villa family.	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
165 Water	----------	----------	----------	----------
166 Whitewolf family. . . .	Severe: cutbanks cave slope	Severe: slope	Severe: slope	Severe: slope
Toquerville family. . .	Severe: depth to rock slope	Severe: slope depth to rock	Severe: depth to rock slope	Severe: depth to rock slope
167 Xeric Torriorthents . .	Slight	Slight	Moderate: *low strength shrink-swell	Moderate: *low strength *shrink-swell dusty
168 Xeric Torriorthents, sodic	Slight	Slight to Moderate: shrink-swell	Moderate to Severe: low strength	Moderate to Severe: low strength dusty

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
169 Xeric Torriorthents, ashy.	Severe: cutbanks cave	Slight	Slight	Severe: too sandy
Durorthids, ashy. . . .	Severe: *cemented pan *cutbanks cave	Moderate to Severe: cemented pan	Moderate to Severe: cemented pan	Severe: *cemented pan too sandy
170 Xerollic Durorthids . .	Severe: *cemented pan *cutbanks cave	Moderate to Severe: cemented pan	Moderate to Severe: cemented pan	Moderate to Severe: cemented pan
171 Yellowrock.	Severe: cutbanks cave	Slight	Slight	Slight
172 Yellowrock.	Severe: cutbanks cave	Slight	Slight	Slight
Seaman.	Slight	Slight	Slight to Moderate: low strength	Moderate: low strength dusty
173 Yermo	Moderate: large stones	Moderate: small stones	Moderate: small stones	Moderate: small stones dusty

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
174				
Yermo, extremely gravelly.	Moderate: small stones *slope	Moderate: slope small stones	Moderate: slope small stones	Moderate: small stones dusty
Yermo, stony.	Moderate: large stones slope	Moderate: slope large stones	Moderate: slope large stones	Moderate: large stones dusty
175				
Zono.	Severe: cutbanks cave slope	Severe: slope	Severe: slope	Severe: too sandy slope
176				
Honova Variant.	Severe: depth to rock	Moderate: depth to rock	Moderate: depth to rock	Moderate: depth to rock
177				
Yermo, extremely gravelly	Moderate: small stones *slope	Moderate: slope *small stones	Moderate: slope *small stones	Moderate: small stones dusty
Yermo, stony	Moderate: large stones slope	Moderate: slope large stones	Moderate: slope large stones	Moderate: large stones dusty

TABLE B -- BUILDING SITE DEVELOPMENT (cont.)

Soil Name and Map Symbol	Shallow Excavations	Building Sites	Surfaced Road Location	Unsurfaced Road Location
178 Entic Durorthids . . .	Severe: cemented pan *slope	Slopes 5 to 15 percent Moderate: slope cemented pan Slopes 15 to 50 percent Severe: slope	Slopes 5 to 15 percent Moderate: slope cemented pan Slopes 15 to 50 percent Severe: slope	Moderate: cemented pan *slope dusty
Typic Durorthids. . . .	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan dusty

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

Sanitary Facilities

The nature of the soil is important in selecting sites for septic tank absorption fields, sewage lagoons, and sanitary landfills, and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Those soil properties that determine the ease of excavation or installation of these facilities will also affect the ratings.

Table C gives soil limitation ratings of slight, moderate, or severe for septic tank absorption fields, sewage lagoons, and trench and area type sanitary landfills. Soil suitability ratings of good, fair, and poor are given for daily cover for landfill.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. The centerline depth of the tile is assumed to be at a depth of 24 inches. Only the soil between depths of 24 and 72 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction of the system, and those that may affect public health.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, cemented pan or ice, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock, ice, or cemented pan interfere with installations. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than four feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration are to be noted.

Percolation tests are used by some regulatory agencies to evaluate the soil's suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity. The percolation rates do not correspond to the permeability rates because they are measured by different methods. Experience indicates that soils having percolation rates (1) faster than 45 minutes per inch function satisfactorily, (2) between 45 and 60 minutes per inch have moderate limitations, and (3) slower than 60 minutes per inch have severe limitations (USDHEW 1969).

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption fields so that satisfactory performance is achieved (Bouma, 1974). However, such considerations are not considered in this guide.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed so that depth of the sewage is two to five feet. Relatively impervious soil for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

Soil permeability is a critical property in evaluating a soil for sewage lagoons. Most porous soils will eventually seal when being used as a sewage lagoon, however, until they do, the hazard of pollution is great and it is difficult to maintain the constant water depth required for proper operation. Soils with a permeability exceeding two inches per hour are generally too porous for proper operation of sewage lagoons and may cause contamination of shallow wells. Fractured bedrock within 40 inches may create a pollution hazard. Bedrock and cemented pans create construction problems.

The slope limits are based on the specification that the effluent be two to five feet deep. If shallower than this, weeds grow, if deeper, it is more difficult to maintain an aerobic environment. Slope must be gentle enough and the soil material thick enough over bedrock or cemented pan to make smoothing for uniformity of lagoon depth practical.

If floodwater overtops the lagoon, it interferes with the functioning of the lagoon and carries away polluting sewage before sufficient decomposition has taken place. Ordinarily, therefore, soils susceptible to flooding have a severe limitation for sewage lagoons. If, however, floodwaters are slow flooding and rarely if ever more than five feet deep--not deep enough to overtop the lagoon embankment--the limitation rating is not severe because of susceptibility to flooding.

Soils containing large amounts of organic matter are unsuitable for the floor of the lagoon. The organic matter promotes anaerobic rather than aerobic environment and is detrimental to the proper functioning of the lagoon.

Depth to water table is important if it influences the water level in the lagoon. If it does, then a pollution hazard also exists. Depth to water table is disregarded if the lagoon floor has slowly permeable soil material at least four feet thick. Soils that contain rock fragments are undesirable sites because the fragments interfere with the manipulation and compaction needed to prepare the lagoon floor.

Sanitary landfill (trench) is a method of disposing of solid waste by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least two feet thick is placed over the landfill.

Ratings are based on properties to a depth normally observed during soil mapping. However, because trenches may be as deep as 15 feet or more, geologic investigations are needed to determine the potential for pollution

of ground water as well as determine the design needed. These investigations, generally arranged for by the landfill developer, include examination of stratification, rock formations, and geologic conditions that might lead to the conducting of leachates to aquifers, wells, water courses, and other water sources. The presence of hard bedrock, creviced bedrock, or highly permeable strata in or immediately underlying the proposed trench bottom is undesirable from the standpoints of excavation and potential pollution of underground water.

Properties that influence risk of pollution, ease of excavation, trafficability, and revegetation are major considerations. Soils that flood or have a water table within the depth of excavation present a potential pollution hazard and cause difficulty in excavating.

Soil slope is an important consideration because it affects the work involved in road construction, the performance of the roads and the control of surface water around the landfill. Soil slope may also cause difficulty in construction of the trenches where the trench bottoms must be kept level and oriented to follow the contour.

The ease with which the trench is dug and with which a soil can be used as daily and final cover is based largely on texture and consistence of the soil. The texture and consistence of a soil determines the degree of workability of the soil both when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and to place in a uniformly thick cover over a layer of refuse.

The uppermost part of the final cover should be soil material that is favorable for the growth of plants. It should not contain excess sodium or salt and should not be too acid. In comparison with other horizons, the A horizon in most soils has the best workability and highest content of organic matter. Thus, for a trench-type landfill operation it may be desirable to stockpile the surface layer for use in final blanketing of the fill.

Sanitary landfill (area) is a method of disposing of solid waste by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the landfill when it is completed. Properties that influence trafficability and risk of pollution are the only considerations for area sanitary landfills.

Flooding is a serious problem because of the risk of washouts and pollution downstream and the difficulty of moving trucks in and out of flooded areas.

Permeability of the soil is an important consideration in all but the most arid parts of the country. If permeability is too rapid, or if fractured bedrock or fractured cemented pan are close to the surface, the risk of the leachate contaminating water supplies is great. A high water table may also transmit pollutants to water supplies and is likely to restrict truck movement during the wet parts of the year.

Slope is a consideration because of the extra grading required to maintain roads on sloping soils. Furthermore, leachate may flow along the soil surface on sloping soils and cause difficult seepage problems in completed fills.

Daily cover for landfill is the soil material that is applied daily to compacted solid waste in an area type sanitary landfill. The cover material is obtained offsite, transported, and spread on the area. The required soil characteristics relative to both daily and final cover material are nearly enough alike for one rating to serve.

Suitability of a soil for use as cover is based on properties that reflect workability, ease of digging, and moving and spreading the material over the refuse daily during both wet and dry periods. Soils that are loamy or silty and free of stones are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soil must be thick enough over bedrock, cemented pan or water table so that material can be removed efficiently and yet leave a borrow area that can be revegetated. Some damage to the borrow area is expected, but if revegetation and erosion could be serious problems, then the soil is rated severe.

Slope affects the ease of excavation and moving of the cover material. Slope also may affect the final configuration of the borrow area and hence runoff, erosion, and reclamation.

In addition to these features, the soils selected for daily cover of landfill should be suitable for growing plants. They should not contain significant amounts of substances toxic to plants such as a high content of sodium or salts.

TABLE C -- SANITARY FACILITIES

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
101					
Alamedawell	Severe: percs slowly	Slight	Moderate: too sandy	Slight	Good to Fair: too sandy
Deepwell.	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
102					
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	Poor: ponding wetness
Aquic Torriorthents . .	Severe: wetness *percs slowly	Severe: wetness	Severe: wetness	Severe: wetness	Fair to Poor: wetness
103					
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	Poor: ponding wetness
Aquic Torriorthents . .	Severe: wetness *percs slowly	Severe: wetness	Severe: wetness	Severe: wetness	Fair to Poor: *wetness
Deepwell.	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
104					
Arizo	Severe: poor filter large stones	Severe: seepage *slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
105					
Arizo	Severe: poor filter large stones	Severe: seepage *slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones too sandy
Yellowrock.	Severe: poor filter	Severe: seepage *slope	Moderate: *slope too sandy *large stones	Slight to Moderate: slope	Fair: too sandy slope *large stones
106					
Badland	Very Severe: slope	Very Severe: slope	Very Severe: slope	Very Severe: slope	Poor: slope
107					
Washoe.	Severe: *percs slowly large stones *slope	Severe: large stones slope	Severe: large stones	Slight to Moderate: slope	Poor: large stones
108					
Washoe.	Severe: *percs slowly large stones *slope	Severe: slope	Severe: large stones	Slight to Moderate: slope	Poor: large stones
Washoe Variant.	Severe: percs slowly	Severe: slope	Slight to Moderate: slope large stones	Slight to Moderate: slope	Fair: *large stones slope
109					
Berent family	Very Severe: slope	Very Severe: slope	Very Severe: slope	Very Severe: slope	Poor: slope

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
109 (cont.)					
Glenbrook family. . . .	Very Severe: slope	Very Severe: slope	Very Severe: slope	Very Severe: slope	Poor: area reclaim slope thin layer
110					
Bitter.	Severe: *percs slowly large stones *slope	Severe: large stones *slope seepage	Severe: large stones	Slight	Poor: large stones
Garlock Variant	Severe: percs slowly	Moderate: slope	Slight to Moderate: large stones	Slight	Good to Fair: large stones *slope
111					
Brantel	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair to Poor: seepage too sandy
112					
Brantel	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
113					
Brantel Variant	Severe: poor filter	Severe: seepage *slope	Severe: too sandy	Slight to Moderate: slope	Poor: seepage too sandy small stones
Brantel	Severe: poor filter	Severe: seepage *slope	Severe: too sandy	Slight	Poor: seepage too sandy

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
114 Buscones.	Severe: depth to rock poor filter	Severe: seepage depth to rock *slope	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
115 Cajon	Severe: poor filter	Severe: seepage	Moderate to Severe: too sandy	Slight	Fair to Poor: seepage too sandy
116 Cashbaugh	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
Buscones.	Severe: depth to rock poor filter	Severe: seepage depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
117 Cashbaugh	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
Brantel	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair to Poor: too sandy seepage
118 Chidago	Severe: depth to rock poor filter	Severe: seepage depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
119 Cowtrack.	Moderate to Severe: percs slowly *slope depth to rock	Moderate to Severe: seepage *slope depth to rock	Severe: depth to rock *slope	Slopes 2 to 15 percent Moderate: depth to rock *slope Slopes 15 to 30 percent Severe: slope	Slopes 2 to 15 percent Fair: area reclaim too sandy *slope thin layer Slopes 15 to 30 percent Poor: slope
120 Cowtrack Variant. . . .	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
121 Cryoborolls	Severe: *depth to rock *percs slowly slope	Severe: *seepage depth to rock slope	Severe: depth to rock slope	Severe: *depth to rock slope	Poor: *area reclaim slope *thin layer
122 Cryoborolls	Severe: *depth to rock *percs slowly *poor filter slope large stones	Severe: seepage *depth to rock slope large stones	Severe: depth to rock *seepage slope *large stones	Severe: *depth to rock *seepage slope	Severe: *area reclaim large stones slope *thin layer
123 Durargids, shallow. . .	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim hard to pack thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
124 Entic Durorthids. . . .	Severe: cemented pan *slope	Severe: cemented pan slope	Severe: cemented pan *slope	Severe: cemented pan *slope	Poor: area reclaim small stones *slope thin layer
Typic Durorthids. . . .	Severe: cemented pan	Severe: cemented pan slope	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim small stones thin layer
125 Pajuela	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones too sandy
126 Pajuela	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones too sandy
Thibau.	Severe: poor filter	Severe: seepage slope	Moderate: *slope too sandy *large stones	Slight to Moderate: slope	Fair: too sandy *slope *large stones
127 Halloran Variant. . . .	Severe: poor filter	Severe: seepage	Severe: cemented pan	Slight	Fair: area reclaim thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
128 Hammil.	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair to Poor: too sandy seepage
129 Haplargids, frigid. . .	Severe: *depth to rock percs slowly slope	Severe: *depth to rock slope	Severe: depth to rock slope	Severe: *depth to rock slope	Poor: *area reclaim *small stones slope *thin layer
Torriorthents, frigid .	Severe: *depth to rock slope	Severe: seepage *depth to rock slope	Severe: depth to rock slope	Severe: *depth to rock slope	Poor: *area reclaim *small stones slope *thin layer
130 Honova.	Severe: depth to rock	Severe: depth to rock *large stones	Severe: depth to rock *large stones	Severe: depth to rock	Poor: area reclaim thin layer
131 Honova Variant.	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
132 Hoye Variant.	Severe: percs slowly	Slight	Moderate: floods	Moderate: floods	Good

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
133 Wellington.	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim thin layer
134 Wellington.	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim thin layer
135 Lithic Torriorthents. .	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Poor: area reclaim *small stones slope thin layer
Lithic Haplargids . . .	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Poor: area reclaim slope thin layer *small stones
136 Lithic Xerollic Haplargids.	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Poor: area reclaim slope thin layer *small stones

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
136 (cont.) Lithic Xeric Torriorthents	Very Severe: slope depth to rock	Very Severe: slope depth to rock seepage	Very Severe: slope depth to rock	Very Severe: slope depth to rock	Poor: area reclaim *small stones slope thin layer
137 Haar family	Severe: depth to rock	Severe: depth to rock *slope	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
138 Xeric Torriorthents, very bouldery	Severe: depth to rock slope	Severe: seepage depth to rock slope large stones	Severe: depth to rock slope large stones	Severe: depth to rock slope	Poor: area reclaim slope thin layer large stones
139 Millner	Moderate: *slope small stones	Severe: seepage *slope	Moderate: slope small stones	Slight to Moderate: slope	Poor: small stones
Millner, stony.	Moderate: *slope small stones	Severe: seepage *slope	Moderate: slope large stones	Slight to Moderate: slope	Poor: small stones
140 Dotard.	Moderate: slope small stones	Severe: seepage slope	Moderate: slope small stones	Slight to Moderate: slope	Poor: small stones

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
141 Pizona.	Severe: *percs slowly slope *large stones	Severe: *seepage slope large stones	Severe: depth to rock *slope large stones	Slopes 8 to 15 percent Moderate: depth to rock slope Slopes 15 to 50 percent Severe: slope	Poor: large stones slope
Brantel	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair to Poor: too sandy seepage
142 Avalmount	Severe: slope *large stones	Severe: slope large stones	Severe: *slope large stones	Slopes 5 to 15 percent Moderate: slope Slopes 15 to 30 percent Severe: slope	Poor: large stones *slope
143 Playa	Severe: wetness percs slowly	Severe: wetness	Severe: wetness excess sodium excess salt	Severe: wetness	Poor: wetness excess salt excess sodium
144 Rock Outcrop.	Very Severe: depth to rock slope	Very Severe: depth to rock slope	Very Severe: depth to rock slope	Very Severe: depth to rock slope	----------

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
145 Rovana.	Severe: poor filter	Severe: seepage slope	Moderate to Severe: too sandy slope	Slight to Moderate: slope	Fair: seepage *too sandy *slope
146 Rovana.	Severe: poor filter	Severe: seepage	Moderate to Severe: too sandy	Slight	Fair: *seepage too sandy
147 Sawavu.	Severe: cemented pan poor filter	Severe: seepage cemented pan	Severe: cemented pan too sandy	Severe: cemented pan	Poor: area reclaim thin layer
Brantel	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair to Poor: seepage too sandy
148 Sherwin	Severe: depth to rock	Severe: depth to rock slope *large stones	Severe: depth to rock *large stones	Severe: depth to rock	Poor: area reclaim thin layer
149 Taboose	Severe: large stones *slope	Severe: seepage slope large stones	Severe: large stones *slope	Moderate: slope	Poor: large stones slope

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
150 Taboose	Severe: large stones *slope	Severe: seepage slope large stones	Severe: large stones	Moderate: slope	Poor: large stones
151 Thibau.	Severe: poor filter	Severe: seepage	Moderate to Severe: too sandy	Slight	Fair: seepage too sandy
152 Thibau.	Severe: poor filter slope	Severe: seepage *slope	Severe: slope *too sandy	Severe: slope	Poor: slope
153 Tinemaha.	Severe: *percs slowly large stones	Severe: *seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
154 Tinemaha.	Severe: *percs slowly large stones	Severe: *seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
Lubkin.	Slight to Moderate: *percs slowly *slope	Severe: seepage slope	Slight to Moderate: slope *large stones	Slight to Moderate: slope	Fair: slope *large stones

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
155 Xeralfic Haplargids, mesic	Severe: *slope large stones	Severe: *seepage slope *large stones	Severe: *slcpe large stones	Slopes 5 to 15 percent Moderate: slope Slopes 15 to 30 percent Severe: slope	Poor: *large stones *slope
156 Lithic Xeric Torriorthents	Very Severe: depth to rock slope	Very Severe: seepage depth to rock slope *large stones	Very Severe: depth to rock slope *large stones	Very Severe: depth to rock slope	Poor: area reclaim slope thin layer
Buscones.	Severe: depth to rock slope	Severe: seepage depth to rock slope	Severe: depth to rock slope	Severe: depth to rock slope	Poor: area reclaim slope thin layer
157 Torriorthents, frigid .	Severe: *depth to rock poor filter slope large stones	Severe: seepage *depth to rock slope large stones	Severe: depth to rock slope *large stones	Severe: *depth to rock slope	Poor: *area reclaim *large stones slope *thin layer
Haplargids, frigid. . .	Severe: *depth to rock percs slowly slope large stones	Severe: *depth to rock slope large stones	Severe: depth to rock slope *large stones	Severe: *depth to rock slope	Poor: *area reclaim *large stones slope *thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
158 Torripsamments.	Severe: poor filter slope	Severe: seepage slope	Severe: slope too sandy	Severe: slope	Poor: slope *too sandy *seepage
Cinder Land	Very Severe: poor filter slope	Very Severe: seepage slope	Very Severe: slope small stones seepage	Severe: slope	Poor: seepage small stones slope
159 Tuttle.	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
160 Tuttle.	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
161 Tuttle.	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
Rovana.	Severe: poor filter	Severe: seepage slope	Moderate: *slope too sandy *large stones	Slight to Moderate: slope	Fair: too sandy *slope *large stones

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
162					
Tuttle.	Severe: poor filter large stones	Severe: seepage slope large stones	Severe: large stones	Slight to Moderate: slope	Poor: large stones
Rovana.	Severe: poor filter	Severe: seepage slope	Moderate: slope too sandy *large stones	Slight to Moderate: slope	Fair: too sandy *slope *large stones
163					
Tuttle Variant.	Moderate: small stones	Severe: seepage	Slight	Slight	Fair to Poor: small stones
164					
Victorville family. . .	Moderate: *percs slowly	Moderate: seepage	Slight	Slight	Good
Villa family.	Moderate: *percs slowly	Severe: seepage	Severe: too sandy	Slight	Poor: too sandy
165					
Water	----------	----------	----------	----------	----------
166					
Whitewolf family. . . .	Severe: poor filter slope	Severe: seepage slope	Severe: depth to rock slope *too sandy	Severe: slope	Poor: *too sandy slope
Toquerville family. . .	Severe: depth to rock slope	Severe: seepage depth to rock slope	Severe: depth to rock slope *too sandy	Severe: slope	Poor: area reclaim *seepage *too sandy slope thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
167 Xeric Torriorthents . .	Severe: percs slowly	Slopes 0 to 7 percent Moderate: *seepage slope Slopes 7 to 15 percent Severe: slope	Slight	Slight	Good to Fair: *slope
168 Xeric Torriorthents, sodic	Moderate to Severe: percs slowly	Slopes 0 to 2 percent Slight Slopes 2 to 9 percent Moderate: slope	Slight to Moderate: too clayey	Slight	Fair: too clayey
169 Xeric Torriorthents, ashy.	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
Durorthids, ashy. . . .	Severe: cemented pan poor filter	Severe: seepage cemented pan	Severe: cemented pan too sandy	Severe: cemented pan	Poor: area reclaim seepage too sandy thin layer
170 Xerollic Durorthids . .	Severe: cemented pan poor filter	Severe: seepage cemented pan	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim thin layer

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
171 Yellowrock.	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Fair: *seepage too sandy
172 Yellowrock.	Severe: poor filter	Severe: seepage	Moderate: too sandy	Slight	Fair: too sandy *small stones
Seaman.	Slight	Severe: seepage	Slight	Slight	Good
173 Yermo	Moderate: small stones percs slowly	Severe: seepage	Moderate: small stones	Slight	Poor: small stones
174 Yermo, extremely gravelly.	Moderate: slope *small stones	Severe: seepage slope	Moderate: *small stones slope	Moderate: slope	Poor: small stones
Yermo, stony.	Moderate: slope large stones	Severe: seepage slope	Severe: large stones	Moderate: slope	Poor: small stones
175 Zono.	Severe: slope	Severe: seepage slope	Severe: depth to rock slope *too sandy	Severe: slope	Poor: slope

TABLE C -- SANITARY FACILITIES (Cont.)

Soil Name and Map Symbol	Septic Tank Absorption Fields	Sewage Lagoons	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
176 Honova Variant.	Severe: depth to rock	Severe: seepage depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: area reclaim thin layer
177 Yermo, extremely gravelly.	Moderate: slope *small stones	Severe: seepage slope	Moderate: *small stones slope	Moderate: slope	Poor: small stones
Yermo, stony.	Moderate: slope large stones	Severe: seepage slope	Severe: large stones	Moderate: slope	Poor: small stones
178 Entic Durorthids. . . .	Severe: cemented pan *slope	Severe: cemented pan slope	Severe: cemented pan *slope	Severe: cemented pan *slope	Poor: area reclaim small stones *slope thin layer
Typic Durorthids. . . .	Severe: cemented pan	Severe: cemented pan slope	Severe: cemented pan	Severe: cemented pan	Poor: area reclaim small stones thin layer

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

Construction Material

Suitability ratings of good, fair, or poor are given in Table D for soils used as a source of roadfill, reconstruction material, and topsoil. Ratings of probable and improbable are given for sand and gravel.

A rating of probable means that on the basis of the available evidence, the source material is likely to occur in or below the soil. A rating of improbable means that the source material is unlikely to occur within or below the soil. This rating does not consider the quality of the source material because quality depends on how the source material will be used.

Roadfill. Roadfill consists of soil material that is excavated from its original position and used in road embankments elsewhere. The evaluations for roadfill are for low embankments generally less than six feet and are less exacting in design than high embankments such as used in superhighways. The rating is given for the whole soil, from the surface to a depth of about five feet, based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. Soils are rated as to the amount of material available for excavation, the ease of excavation, and how well the material performs after it is in place.

Soil properties that affect the amount of material available for excavation are thickness of suitable material above bedrock or other material that is not as suitable. The percent of coarse fraction greater than three inches, depth to high water table, and slope are properties that influence the ease of excavation. How well the soil performs in place is indicated by the AASHTO classification and group index and the shrink-swell potential. Some damage to the borrow area is expected, but if revegetation and erosion control could become serious problems, then the soil is rated poor.

Sand. Sand as a construction material is usually defined as the size of particles ranging from .074 mm (sieve No. 200) to 4.76 mm (sieve No. 4) in diameter. Sand is used in great quantities in many kinds of construction. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the sand for specific purposes is not evaluated.

The properties used to evaluate the soils as a probable source for sand are the grain size as indicated by the Unified Soil Classification, the thickness of the sand layer, and the amount of rock fragments in the soil material.

If the lowest layer of the soil contains sand, the soil is rated as a probable source regardless of thickness. The assumption is that the sand layer below the depth of observation exceeds the minimum thickness.

Gravel. Gravel as a construction material is defined as the size of particles ranging from 4.76 mm (sieve No. 4) to 76 mm (3 inches) in diameter. Gravel is used in great quantities in many kinds of construction. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the gravel for specific purposes is not evaluated.

The properties used to evaluate the soil as a probable source for gravel are grain size as indicated by the Unified Soil Classification, the thickness of the gravel layer, and the amount of rock fragments in the soil material. If the lowest layer of the soil contains gravel, the soil is rated as a probable source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness.

Topsoil. The term "topsoil" has several meanings, but as used here, the term describes soil material used to cover an area so as to improve soil conditions for establishment and maintenance of adapted vegetation.

Generally the organic rich upper part of the soil is most desirable, however, material excavated from deeper layers is also used. In this rating, the upper 40 inches of soil material is evaluated for its use as topsoil. In the borrow area, the material below 40 inches is evaluated for its suitability to grow vegetation after the upper 40 inches is removed.

The soil properties that are used to rate the soil as topsoil are those that influence plant growth, the ease of excavation, loading and spreading, and those which influence the reclamation of the borrow area.

The physical and chemical soil properties that influence plant growth are the presence of toxic substances, soil reaction, and those properties which are inferred from the soil texture such as available water capacity and fertility. The properties that influence the ease of excavation, loading, and spreading are the amounts of rock fragments, slope, depth to the water table, soil texture, and thickness of suitable material. The properties that influence the reclamation of the borrow area are slope, depth to water table, amount of rock fragments, depth to rock, and the presence of toxic material.

Soil Reconstruction Material for Mined Areas. Soil reconstruction of areas drastically disturbed, as in surface mining, is the process of replacing layers of soil material or unconsolidated geologic material or both in a vertical sequence of such quality and thickness that they provide a favorable medium for plant growth.

Most new state strip mine programs emphasize that the land surface be restored to about its natural configuration or better and the soil be reconstructed to maintain or improve its suitability for the intended use. Thus, a knowledge of the soil and underlying material is needed to plan proper reconstruction operations of mined land. This rating for soil reconstruction material evaluates the material as a medium for plant growth. This rating does not cover quarry, pit, dredge, and older surface mine operations that require an off-site source of soil reconstruction material--the rating "Daily Cover for Sanitary Landfill" is useful to evaluate the material used in restoration of these operations.

When the soil materials are properly used in reconstruction, a good rating means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated fair can be vegetated and stabilized by

modifying one or more properties. Top dressing with better material or application of soil amendments may be necessary for satisfactory performance. Material rated poor has such severe problems that revegetation and stabilization are very difficult and costly. Top dressing with better material is necessary to establish and maintain vegetation.

The major properties that influence erosion and stability of the surface and the productive potential of the reconstructed soil are listed in the ratings.

Excessive amounts of substances that restrict plant growth such as sodium, salt, sulfur, copper, and nickel create problems in establishing vegetation and, therefore, also influence erosion and the stability of the surface. Other substances such as selenium, boron, and arsenic get into the food chain and are toxic to animals that eat the vegetation. Of all these substances, only sodium and salt are criteria in the guide. If relatively high levels of toxic substances are in the reconstruction material, the material should be rated poor. Laboratory tests may be needed to properly identify toxic substances.

Materials that are extremely acid or have the potential upon oxidation of becoming extremely acid are difficult and expensive to vegetate, and contribute to poor quality of water, both in runoff and in ground water. Materials high in pyrite and marcasite without off-setting bases have high potential acidity. Laboratory tests may be needed to properly identify these materials.

Vegetation is difficult to establish on soils with high pH. Many of these soils also have a high sodium adsorption ratio which indicates potential instability and water transmission problems.

Available water capacity also is important in establishing vegetation. Soils with low available water capacity may require irrigation for establishment of vegetation.

The stability of the soil depends upon its erodibility by water and wind and its strength. Water erodibility is indicated by the K factor; wind erodibility is rated according to the wind erodibility group. Potential slippage hazard is related to soil texture, and although other factors also contribute, the ratings of soil texture represent one important factor.

USDA texture also influences a number of properties listed above such as available water capacity and erodibility by wind or water. Texture also influences soil structure and consistence, water intake rate, runoff, fertility, workability, and trafficability.

Fraction >3 inches is a weight percentage of rock fragments in the material used for soil reconstruction. Rock fragments influence the ease of excavation, stockpiling and respreading, and suitability for the final use of the land. A certain amount of rock fragments can be tolerated depending on the size and the intended use of the reclaimed area. If the size of rock fragments exceeds 10 inches, the problems are more severe.

This rating does not cover all the soil features required in planning soil reconstruction, for example, slope, thickness of material, ease of excavation, potential slippage hazard, and soil moisture regime. Slope of the original soil may influence the method of stripping and stockpiling of reconstruction material but may have little effect on the final contour and therefore, on the stability and productivity of the reconstructed soil. Therefore, slope is not a criterion in this guide.

Thickness of material suitable for reconstruction and ease of excavation are important criteria in planning soil reconstruction operations. However, they are so dependent on the method of mining operations that they cannot be used as criteria in this guide. Potential slippage hazard is related to soil texture, slope, differential permeability between layers, rainfall, and other factors which are not included in the guide. Soil moisture regime, climate, and weather influence the kind of vegetation to plant and the rate of revegetative growth. They are not used as criteria because the relative ranking does not change with variable moisture regimes, that is, the best soil in a moist environment is the best soil in a dry environment. Furthermore, the soil may be irrigated to establish vegetation.

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
101					
Alamedawell	Good to Fair: low strength	Improbable Source: excess fines thin layer	Improbable Source: excess fines	Fair: area reclaim thin layer too sandy	Fair to Poor: excess sodium excess lime soil blowing too sandy
Deepwell.	Good	Probable Source	Improbable Source: too sandy	Poor: too sandy	Poor: soil blowing too sandy
102					
Aquents	Poor: *low strength wetness	Improbable Source: excess fines	Improbable Source: excess fines	Poor: *excess salt wetness excess sodium	Poor: excess sodium excess lime
Aquic Torriorthents . .	Good to Fair: low strength wetness	Improbable Source: excess fines	Improbable Source: excess fines	Poor: *excess salt excess sodium	Poor: excess sodium excess salt excess lime
103					
Aquents	Poor: *low strength wetness	Improbable Source: excess fines	Improbable Source: excess fines	Poor: *excess salt wetness excess sodium	Poor: excess sodium excess lime
Aquic Torriorthents . .	Fair: *low strength wetness	Improbable Source: excess fines	Improbable Source: excess fines	Poor: *excess salt excess sodium	Poor: excess sodium excess salt excess lime

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
103 (cont.) Deepwell.	Good	Probable Source	Improbable Source: too sandy	Poor: too sandy	Poor: soil blowing too sandy
104 Arizo	Poor: large stones	Improbable Source: excess fines large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones
105 Arizo	Poor: large stones	Improbable Source: excess fines large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones
Yellowrock.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy *large stones *slope	Fair: *large stones droughty too sandy
106 Badland	Poor: *low strength slope	Improbable Source: excess fines	Improbable Source: excess fines	Poor: excess sodium slope	Poor: excess sodium excess lime toxicity
107 Washoe.	Poor: *low strength large stones	Improbable Source: excess fines large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones
108 Washoe.	Poor: *low strength large stones	Improbable Source: excess fines *large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
108 (cont.) Washoe Variant.	Fair to Poor: low strength *large stones	Improbable Source: excess fines	Improbable Source: excess fines	Fair: *too clayey *large stones	Fair: too clayey *large stones
109 Berent family	Poor: slope	Probable Source	Improbable Source: too sandy	Poor: slope	Fair to Poor: droughty too sandy
Glenbrook family. . . .	Poor: slope	Improbable Source: thin layer	Improbable Source: too sandy thin layer	Poor: area reclaim thin layer	Poor: droughty large stones too sandy
110 Bitter.	Poor: *low strength large stones	Improbable Source: excess fines *large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones
Garlock Variant	Poor: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Fair: too clayey *large stones	Fair: too clayey *large stones
111 Brantel	Good	Improbable Source: excess fines	Improbable Source: excess fines	Fair: too sandy	Poor: soil blowing too sandy
112 Brantel	Good	Probable Source	Improbable Source: excess fines	Poor: too sandy	Poor: soil blowing too sandy

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
113 Brantel Variant	Good	Probable Source	Probable Source	Poor: too sandy small stones area reclaim	Poor: droughty too sandy soil blowing
Brantel	Good	Probable Source	Improbable Source: too sandy	Poor: too sandy	Poor: soil blowing too sandy
114 Buscones.	Poor: area reclaim *thin layer	Improbable Source: *excess fines thin layer	Improbable Source: excess fines thin layer	Fair: area reclaim too sandy thin layer	Poor: soil blowing too sandy
115 Cajon	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy	Poor: soil blowing *too sandy *droughty
116 Cashbaugh	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Poor: soil blowing
Buscones.	Poor: area reclaim *thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Fair: area reclaim too sandy thin layer	Poor: soil blowing

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
117 Cashbaugh	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Poor: soil blowing too sandy
Brantel	Good	Improbable Source: excess fines	Improbable Source: excess fines	Fair: too sandy	Poor: soil blowing too sandy
118 Chidago	Poor: area reclaim *thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Fair: area reclaim too sandy thin layer	Poor: soil blowing too sandy
119 Cowtrack.	Fair: area reclaim thin layer slope	Improbable Source: excess fines	Improbable Source: excess fines	Slopes 2 to 15 percent Fair: too sandy *slope Slopes 15 to 30 percent Poor: slope	Poor: soil blowing too sandy
120 Cowtrack Variant. . . .	Good	Probable Source	Improbable Source: too sandy	Poor: too sandy	Poor: soil blowing too sandy
121 Cryoborolls	Poor: *area reclaim *low strength *slope	Improbable Source: excess fines *thin layer	Improbable Source: excess fines *thin layer	Poor: small stones *area reclaim *thin layer slope	Fair: *droughty *too clayey

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
122 Cryoborolls	Fair to Poor: area reclaim large stones thin layer slope	Improbable Source: *excess fines *thin layer *large stones	Improbable Source: excess fines *thin layer *large stones	Poor: *area reclaim *large stones *thin layer slope	Fair to Poor: *droughty *too sandy large stones
123 Durargids, shallow. . .	Poor: low strength thin layer *shrink-swell area reclaim	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim *too clayey thin layer	Fair to Poor: too clayey
124 Entic Durorthids. . . .	Poor: thin layer *slope area reclaim	Improbable Source: excess fines thin layer	Probable Source	Poor: small stones *slope	Fair to Poor: excess lime droughty large stones
Typic Durorthids. . . .	Poor: thin layer area reclaim	Improbable Source: excess fines thin layer	Probable Source	Poor: area reclaim small stones thin layer	Poor: droughty large stones
125 Pajuela	Poor: large stones	Improbable Source: excess fines large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones
126 Pajuela	Poor: large stones	Improbable Source: excess fines large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
126 (cont.) Thibau.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy *large stones *slope	Fair: *large stones droughty soil blowing too sandy
127 Halloran Variant. . . .	Good	Improbable Source: excess fines	Improbable Source: excess fines	Poor: *excess salt excess sodium	Poor: excess sodium excess salt excess lime toxicity
128 Hammil.	Good	Improbable Source: excess fines	Improbable Source: excess fines	Fair: too sandy	Poor: soil blowing too sandy
129 Haplargids, frigid. . .	Poor: *area reclaim low strength *slope *thin layer	Improbable Source: excess fines *thin layer	Improbable Source: excess fines *thin layer	Poor: small stones *area reclaim *thin layer slope	Fair: *excess lime *droughty too clayey *large stones
Torriorthents, frigid .	Poor: *area reclaim *slope *thin layer	Improbable Source: excess fines *thin layer	Improbable Source: excess fines *thin layer	Poor: small stones *area reclaim *thin layer slope	Fair: excess lime droughty *large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
130 Honova.	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim *large stones thin layer	Fair to Poor: large stones
131 Honova Variant.	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Poor: droughty too sandy
132 Hoye Variant.	Fair to Poor: low strength *shrink-swell	Improbable Source: excess fines	Improbable Source: excess fines	Fair: too clayey	Fair: *excess lime erodes easily too clayey
133 Wellington.	Poor: area reclaim low strength thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Fair to Poor: erodes easily too clayey
134 Wellington.	Poor: area reclaim low strength thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Fair to Poor: erodes easily too clayey
135 Lithic Torriorthents. .	Poor: area reclaim thin layer slope	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim small stones thin layer slope	Fair: excess lime droughty *large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
135 (cont.) Lithic Haplargids . . .	Poor: area reclaim low strength thin layer slope	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim small stones thin layer slope	Fair: excess lime *large stones too clayey
136 Lithic Xerollic Haplargids.	Poor: area reclaim low strength thin layer slope	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim small stones thin layer slope	Fair: *excess lime *large stones too clayey *droughty
Lithic Xeric Torriorthents	Poor: area reclaim thin layer slope	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim small stones thin layer slope	Fair: *excess lime *large stones droughty
137 Haar family	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Fair: droughty soil blowing
138 Xeric Torriorthents, very bouldery	Poor: area reclaim *thin layer *slope large stones	Improbable Source: excess fines thin layer large stones	Improbable Source: excess fines thin layer large stones	Poor: *area reclaim large stones *thin layer slope	Poor: large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
139 Millner	Fair: low strength large stones	Improbable Source: small stones excess fines	Probable Source	Poor: small stones	Fair to Poor: droughty *large stones excess lime
Millner, stony.	Fair: low strength large stones	Improbable Source: small stones excess fines	Probable Source	Poor: small stones	Fair to Poor: droughty large stones excess lime
140 Dotard.	Fair: low strength large stones	Improbable Source: excess fines small stones	Probable Source	Poor: small stones	Fair to Poor: excess lime droughty large stones
141 Pizona.	Poor: large stones *slope	Improbable Source: excess fines *large stones	Improbable Source: excess fines *large stones	Poor: large stones area reclaim slope	Poor: large stones
Brantel	Good	Improbable Source: excess fines	Improbable Source: excess fines	Poor: too sandy	Poor: soil blowing too sandy
142 Avalmount	Poor: large stones *slope	Improbable Source: excess fines large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim *slope	Poor: large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
143 Playa	Fair to Poor: low strength wetness	Improbable Source: excess fines	Improbable Source: excess fines	Poor: excess sodium	Poor: excess sodium excess salt excess lime *droughty soil blowing
144 Rock Outcrop.	----------	----------	----------	----------	----------
145 Rovana.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy small stones *slope	Fair: soil blowing too sandy droughty
146 Rovana.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy small stones	Fair to Poor: soil blowing too sandy droughty
147 Sawavu.	Poor: area reclaim *thin layer	Improbable Source: *excess fines thin layer	Improbable Source: excess fines thin layer	Fair: area reclaim too sandy thin layer	Poor: soil blowing too sandy
Brantel	Good	Improbable Source: excess fines	Improbable Source: *excess fines	Fair: too sandy	Poor: soil blowing too sandy

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
148 Sherwin	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim large stones thin layer	Poor: large stones
149 Taboose	Poor: large stones *slope	Improbable Source: *excess fines *large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim *slope	Poor: large stones
150 Taboose	Poor: large stones	Improbable Source: *excess fines *large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones
151 Thibau.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy small stones	Fair: soil blowing too sandy droughty
152 Thibau.	Fair: slope	Probable Source	Improbable Source: too sandy	Poor: *too sandy slope	Fair to Poor: soil blowing too sandy
153 Tinemaha.	Poor: *low strength large stones	Improbable Source: excess fines large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
154 Tinemaha.	Poor: *low strength large stones	Improbable Source: excess fines large stones	Improbable Source: excess fines large stones	Poor: large stones area reclaim	Poor: large stones
Lubkin.	Good to Fair: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Fair: *large stones slope	Fair: droughty *large stones
155 Xeralfic Haplargids, mesic	Poor: *large stones *slope	Improbable Source: excess fines *large stones	Improbable Source: excess fines *large stones	Poor: large stones area reclaim *slope	Poor: large stones
156 Lithic Xeric Torriorthents	Poor: *area reclaim *thin layer slope	Improbable Source: excess fines *thin layer	Improbable Source: excess fines *thin layer	Poor: *area reclaim small stones thin layer slope	Fair: droughty *large stones
Buscones.	Poor: area reclaim *thin layer	Improbable Source: *excess fines thin layer	Improbable Source: *excess fines thin layer	Poor: slope	Fair to Poor: droughty too sandy soil blowing
157 Torriorthents, frigid .	Poor: *area reclaim *thin layer large stones *slope	Improbable Source: *excess fines *thin layer large stones	Improbable Source: *excess fines *thin layer large stones	Poor: *area reclaim large stones *thin layer slope	Poor: droughty large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
157 (cont.) Haplargids, frigid. . .	Poor: *area reclaim *thin layer large stones *slope	Improbable Source: excess fines *thin layer large stones	Improbable Source: excess fines *thin layer large stones	Poor: *area reclaim large stones *thin layer slope	Poor: large stones
158 Torripsamments.	Slopes 15 to 25 percent Fair: slope Slopes 25 to 50 percent Poor: slope	Probable Source	Improbable Source: too sandy	Poor: small stones slope	Poor: droughty soil blowing too sandy
Cinder Land	Poor: slope	Probable Source	Probable Source	Very Poor: small stones area reclaim slope	Very Poor: droughty
159 Tuttle.	Poor: large stones	Improbable Source: large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones
160 Tuttle.	Poor: large stones	Improbable Source: large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones
161 Tuttle.	Poor: large stones	Improbable Source: large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: droughty large stones

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
161 (cont.) Rovana.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy *large stones slope	Fair: soil blowing *large stones droughty
162 Tuttle.	Poor: large stones	Improbable Source: large stones	Improbable Source: large stones	Poor: large stones area reclaim	Poor: *droughty large stones
Rovana.	Good	Probable Source	Improbable Source: too sandy	Fair: too sandy *large stones slope	Fair: soil blowing *large stones droughty
163 Tuttle Variant.	Good to Fair: large stones low strength	Probable Source	Improbable Source: excess fines	Poor: small stones	Fair: droughty soil blowing large stones
164 Victorville family. . .	Fair: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Poor: excess salt excess sodium	Poor: excess sodium excess salt excess lime
Villa family.	Good	Probable Source	Improbable Source: too sandy	Poor: excess salt excess sodium	Poor: excess sodium excess salt excess lime soil blowing
165 Water	----------	----------	----------	----------	----------

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
166 Whitewolf family. . . .	Slopes 15 to 25 percent Fair: area reclaim thin layer slope Slopes 25 to 50 percent Poor: slope	Probable Source	Improbable Source: too sandy	Poor: *too sandy slope	Fair to Poor: droughty too sandy
Toquerville family. . .	Poor: area reclaim thin layer *slope	Improbable Source: *excess fines thin layer	Improbable Source: *too sandy thin layer	Poor: area reclaim thin layer *small stones slope	Poor: too sandy large stones droughty
167 Xeric Torriorthents . .	Poor: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Fair: *too clayey *slope	Fair: soil blowing *too clayey
168 Xeric Torriorthents, sodic	Fair to Poor: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Poor: excess sodium	Poor: excess sodium
169 Xeric Torriorthents, ashy.	Good	Probable Source	Improbable Source: too sandy	Poor: too sandy	Poor: droughty soil blowing too sandy

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
169 (cont.)					
Durorthids, ashy. . . .	Poor: area reclaim *thin layer	Improbable Source: thin layer	Improbable Source: thin layer	Poor: *area reclaim *too sandy thin layer	Poor: droughty soil blowing too sandy
170					
Xerollic Durorthids . .	Poor: area reclaim *thin layer	Improbable Source: *excess fines thin layer	Improbable Source: excess fines thin layer	Fair to Poor: area reclaim thin layer too sandy	Fair to Poor: droughty soil blowing too sandy
171					
Yellowrock.	Good	Probable Source	Improbable Source: too sandy	Poor: *excess salt excess sodium too sandy	Poor: excess sodium *excess salt excess lime droughty soil blowing
172					
Yellowrock.	Good	Probable Source	Improbable Source: too sandy	Fair to Poor: too sandy *excess sodium	Poor: *excess sodium excess lime *droughty soil blowing
Seaman.	Good to Fair: low strength	Improbable Source: excess fines	Improbable Source: excess fines	Good	Fair: excess lime soil blowing

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
173 Yermo	Fair: large stones low strength	Improbable Source: small stones excess fines	Probable Source	Poor: small stones area reclaim excess salt excess sodium	Poor: excess sodium excess salt excess lime droughty
174 Yermo, extremely gravelly.	Fair: low strength large stones	Improbable Source: small stones excess fines	Probable Source	Poor: small stones area reclaim	Fair to Poor: droughty large stones excess lime
Yermo, stony.	Fair: large stones low strength	Improbable Source: small stones excess fines	Probable Source	Poor: small stones area reclaim	Fair to Poor: droughty large stones excess lime
175 Zono.	Slopes 15 to 25 percent Fair: area reclaim thin layer slope Slopes 25 to 50 percent Poor: slope	Improbable Source: excess fines	Improbable Source: *excess fines	Poor: *too sandy slope	Poor: soil blowing too sandy
176 Honova Variant.	Poor: area reclaim thin layer	Improbable Source: excess fines thin layer	Improbable Source: excess fines thin layer	Poor: area reclaim thin layer	Poor: too sandy droughty

TABLE D -- CONSTRUCTION MATERIALS

Soil Name and Map Symbol	Roadfill	Sand	Gravel	Topsoil	Soil Reconstruction Material for Mined Areas
177 Yermo, extremely gravelly.	Fair: low strength large stones	Improbable Source: small stones excess fines	Probable Source	Poor: small stones area reclaim	Fair to Poor: droughty large stones
Yermo, stony.	Fair: large stones low strength	Improbable Source: small stones excess fines	Probable Source	Poor: small stones area reclaim	Poor: *droughty large stones
178 Entic Durorthids. . . .	Poor: thin layer *slope area reclaim	Improbable Source: excess fines thin layer	Probable Source	Poor: small stones *slope	Fair to Poor: excess lime droughty large stones
Typic Durorthids. . . .	Poor: thin layer *slope area reclaim	Improbable Source: excess fines thin layer	Probable Source	Poor: area reclaim small stones thin layer	Poor: droughty large stones

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

Water Management

Interpretations of soils for water management are given in Table E as limitations for pond reservoir areas, embankments, dikes and levees, and irrigated agriculture.

Pond reservoir area is the area that holds water behind a dam or embankment. Soils best suited to this use have a low seepage potential which is determined by permeability and depth to fractured or permeable bedrock, cemented pan, or other permeable material. The soil is rated on its properties in the upper 60 inches as a natural barrier against seepage into deeper layers without regard to cutoff trenches or other features that may be installed under the pond embankment. Excessive slopes in the direction perpendicular to the axis of the pond embankment will seriously reduce the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material constructed to impound water or protect land against overflow. They are generally less than 20 feet high, constructed of "homogeneous" soil material (without a core zone) and compacted to medium density. Embankments having zoned construction (core and shell) are not considered.

Ratings are made for soil as a source of material for embankment fills. The rating is given for the whole soil, from the surface to a depth of about five feet, based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. The ratings do not indicate the suitability of the natural soil for supporting the embankment. Soil properties to depths greater than the embankment height will have an effect on the embankment performance and safety. Generally, deeper onsite geologic investigations must be made to determine these important properties. Low density silts and clays in the supporting foundation usually have excessive settlement and low strength. Loose soils in arid regions will undergo large rapid settlements upon saturation as water is impounded. These soils will generally not provide adequate support for embankments.

Embankments, dikes, and levees require soil material that is resistant to seepage, piping, and erosion, and that has favorable compaction characteristics. Organic soils are not suitable because of high compression, low strength, and unpredictable permeability. When compacting with tamping rollers (sheepsfoot) or pneumatic rollers, stones over six inches in size must be removed, causing restrictions for stony soils. If a water table is present, the depth of usable material and the trafficability are affected.

The content of sodium and salts affects the capability for growing vegetation on embankment surfaces. These properties may also indicate dispersive soils that are highly erodible and susceptible to piping.

Irrigated agriculture involves the controlled application of water to supplement rainfall for supporting plant growth. Soil features are listed that affect design, layout, construction, management or performance of an irrigation system. Those features important in design and management of most irrigation systems are wetness or ponding and the need for drainage,

flooding, available water capacity, intake rate, permeability, susceptibility to wind or water erosion, and slope. Soil features that influence construction are large stones and depth to bedrock or cemented pan. The features that affect performance of the system are rooting depth, amount of salts or sodium, and soil acidity.

TABLE E -- WATER MANAGEMENT

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
101 Alamedawell	Slopes 0 to 3 percent favorable Slopes 3 to 9 percent slope	*piping excess sodium	fast intake soil blowing *percs slowly *slope excess sodium
Deepwell.	seepage	seepage *piping	droughty fast intake soil blowing *slope
102 Aquents	*seepage	*seepage *piping ponding wetness excess sodium	wetness ponding *droughty excess sodium
Aquic Torriorthents . .	*seepage	*seepage *piping wetness excess sodium *excess salt	*soil blowing *erodes easily excess sodium *excess salt
103 Aquents	*seepage	seepage *piping ponding wetness excess sodium	wetness ponding *droughty excess sodium

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
103 (cont.) Aquic Torriorthents . .	*seepage	*seepage *piping wetness excess sodium *excess salt	*soil blowing *erodes easily excess sodium *excess salt
Deepwell.	seepage	seepage slope	droughty fast intake soil blowing *slope
104 Arizo	seepage slope	seepage *piping large stones	large stones droughty fast intake slope
105 Arizo	seepage slope	seepage *piping large stones	large stones droughty fast intake slope
Yellowrock.	seepage slope	seepage *piping *large stones	droughty fast intake soil blowing slope
106 Badland	slope	piping	slope erodes easily excess sodium

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
107 Washoe.	seepage slope	large stones	large stones fast intake slope
108 Washoe.	seepage slope	large stones	large stones fast intake slope
Washoe Variant.	seepage slope	*large stones	slope *fast intake soil blowing
109 Berent family	depth to rock slope	thin layer seepage *piping	droughty fast intake slope
Glenbrook family. . . .	depth to rock slope	thin layer seepage *piping *large stones	droughty fast intake depth to rock slope
110 Bitter.	seepage slope	*piping large stones	large stones fast intake slope
Garlock Variant	seepage slope	*piping	slope soil blowing *fast intake

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
111 Brantel	seepage slope	seepage *piping	droughty fast intake soil blowing slope
112 Brantel	seepage slope	seepage *piping	fast intake soil blowing droughty *slope
113 Brantel Variant	seepage slope	seepage	droughty fast intake soil blowing slope
Brantel	seepage slope	seepage piping	droughty fast intake soil blowing slope
114 Buscones.	seepage depth to rock slope	thin layer seepage *piping	*droughty fast intake soil blowing depth to rock slope
115 Cajon	seepage	seepage *piping	droughty fast intake soil blowing

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
116 Cashbaugh	depth to rock	thin layer seepage piping	droughty fast intake soil blowing depth to rock
Buscones.	seepage depth to rock	thin layer seepage *piping	droughty fast intake soil blowing depth to rock
117 Cashbaugh	depth to rock	thin layer seepage piping	*droughty fast intake soil blowing depth to rock
Brantel	seepage	seepage piping	*droughty fast intake soil blowing
118 Chidago	seepage depth to rock slope	thin layer seepage piping	fast intake soil blowing depth to rock slope
119 Cowtrack.	*seepage depth to rock *slope	thin layer seepage piping	fast intake soil blowing slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
120 Cowtrack Variant. . . .	seepage *slope	seepage piping	droughty fast intake soil blowing *slope
121 Cryoborolls	*seepage depth to rock slope	thin layer *large stones	slope *depth to rock droughty
122 Cryoborolls	*seepage depth to rock slope	*seepage *piping large stones	slope *droughty *depth to rock
123 Durargids, shallow. . .	cemented pan slope	thin layer *hard to pack	cemented pan percs slowly slope
124 Entic Durorthids. . . .	seepage cemented pan slope	thin layer *large stones	cemented pan slope droughty
Typic Durorthids. . . .	cemented pan slope	thin layer *large stones	cemented pan slope droughty
125 Pajuela	seepage slope	seepage *piping large stones	large stones droughty fast intake slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
126			
Pajuela	seepage slope	seepage *piping large stones	large stones droughty fast intake slope
Thibau.	seepage slope	seepage *piping *large stones	droughty fast intake soil blowing slope
127			
Halloran Variant. . . .	seepage	seepage *piping excess sodium	droughty soil blowing excess sodium *excess salt
128			
Hammil.	seepage	seepage *piping	droughty fast intake soil blowing
129			
Haplargids, frigid. . .	depth to rock slope	thin layer *large stones	slope *depth to rock droughty
Torriorthents, frigid .	seepage depth to rock slope	thin layer *seepage *large stones	slope *depth to rock droughty
130			
Honova.	depth to rock *slope	thin layer *large stones	depth to rock large stones *slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
131			
Honova Variant.	depth to rock	thin layer	depth to rock fast intake soil blowing slope droughty
132			
Hoye Variant.	favorable	piping	percs slowly
133			
Wellington.	cemented pan slope	thin layer piping	cemented pan soil blowing *large stones slope
134			
Wellington.	cemented pan slope	thin layer piping	cemented pan soil blowing *large stones slope
135			
Lithic Torriorthents. .	depth to rock slope *seepage	thin layer *seepage *large stones	depth to rock slope
Lithic Haplargids . . .	depth to rock slope	thin layer *large stones	depth to rock slope
136			
Lithic Xerollic Haplargids.	depth to rock slope	thin layer *large stones	depth to rock slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
136 (cont.) Lithic Xeric Torriorthents	depth to rock slope *seepage	thin layer *seepage *large stones	depth to rock slope
137 Haar family	depth to rock *slope	thin layer *seepage piping	depth to rock slope
138 Xeric Torriorthents, very bouldery	slope depth to rock seepage	*thin layer *seepage *piping *large stones	large stones *droughty depth to rock slope
139 Millner	seepage slope	seepage *piping *large stones	*large stones droughty slope
Millner, stony.	seepage slope	seepage *piping *large stones	*large stones droughty slope
140 Dotard.	seepage slope	*seepage *large stones *piping	*large stones droughty slope
141 Pizona.	slope depth to rock	thin layer *piping large stones	large stones slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
141 (cont.) Brantel	seepage	seepage *piping	*droughty fast intake soil blowing
142 Avalmount	seepage slope	*seepage piping large stones	large stones droughty slope
143 Playa	*seepage	piping wetness excess sodium excess salt	excess sodium excess salt *wetness
144 Rock Outcrop	----------	----------	----------
145 Rovana	seepage slope	seepage *piping	droughty fast intake soil blowing slope
146 Rovana	seepage	seepage *piping	droughty fast intake soil blowing
147 Sawavu	seepage cemented pan slope	thin layer seepage *piping	fast intake soil blowing cemented pan slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
147 (cont.) Brantel	seepage slope	seepage *piping	fast intake soil blowing slope
148 Sherwin	depth to rock slope	thin layer *seepage *piping *large stones	depth to rock large stones slope droughty
149 Taboose	seepage slope	*seepage large stones piping	*large stones slope droughty
150 Taboose	seepage slope	*seepage large stones piping	large stones droughty slope
151 Thibau.	seepage slope	seepage *piping	droughty fast intake soil blowing slope
152 Thibau.	seepage slope	seepage *piping	droughty fast intake soil blowing slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
153 Tinemaha.	seepage slope	*seepage large stones	large stones *fast intake slope
154 Tinemaha.	seepage slope	*seepage large stones	large stones *fast intake slope
Lubkin.	seepage slope	*seepage	slope *fast intake soil blowing
155 Xeralfic Haplargids, mesic	seepage slope	*seepage *piping large stones	large stones droughty *fast intake slope
156 Lithic Xeric Torriorthents	seepage depth to rock slope	thin layer *seepage *large stones	depth to rock *large stones slope droughty
Buscones.	seepage depth to rock slope	thin layer seepage *piping	droughty fast intake soil blowing depth to rock slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
157 Torriorthents, frigid .	seepage depth to rock slope	thin layer seepage large stones	large stones slope depth to rock droughty
Haplargids, frigid. . .	*seepage depth to rock slope	thin layer *seepage large stones	large stones slope depth to rock droughty
158 Torripsamments.	seepage slope	seepage	droughty fast intake soil blowing slope
Cinderland.	seepage slope	seepage	droughty fast intake slope
159 Tuttle.	seepage slope	seepage large stones *piping	large stones droughty fast intake slope
160 Tuttle.	seepage slope	seepage large stones *piping	large stones droughty fast intake slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
161			
Tuttle.	seepage slope	seepage *piping large stones	large stones droughty fast intake slope
Rovana.	seepage slope	seepage *piping *large stones	droughty fast intake soil blowing slope
162			
Tuttle.	seepage slope	seepage *piping large stones	large stones droughty fast intake slope
Rovana.	seepage slope	seepage *piping *large stones	droughty fast intake soil blowing slope
163			
Tuttle Variant.	seepage	seepage *piping large stones	droughty soil blowing
164			
Victorville family. . .	*seepage	piping excess sodium excess salt	excess sodium soil blowing excess salt droughty

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
164 (cont.) Villa family.	seepage	seepage *piping *excess sodium *excess salt	droughty fast intake soil blowing excess sodium excess salt
165 Water	----------	----------	----------
166 Whitewolf family. . . .	seepage depth to rock slope	thin layer seepage *piping	droughty fast intake slope
Toquerville family. . .	depth to rock slope	thin layer seepage *piping *large stones	droughty fast intake depth to rock slope
167 Xeric Torriorthents . .	Slopes 0 to 3 percent favorable Slopes 3 to 15 percent slope	favorable	*fast intake soil blowing *slope
168 Xeric Torriorthents, sodic	Slopes 0 to 3 percent favorable Slopes 3 to 15 percent slope	excess sodium excess salt	excess sodium *slope *erodes easily

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
169			
Xeric Torriorthents, ashy.	seepage	seepage *piping	droughty fast intake soil blowing
Durorthids, ashy. . . .	seepage cemented pan	thin layer seepage *piping	droughty fast intake soil blowing cemented pan
170			
Xerollic Durorthids . .	seepage cemented pan slope	thin layer seepage *piping	droughty fast intake soil blowing cemented pan slope
171			
Yellowrock.	seepage	seepage *piping excess sodium *excess salt	droughty fast intake soil blowing excess sodium *excess salt
172			
Yellowrock.	seepage	seepage *piping *excess sodium	droughty fast intake soil blowing *excess sodium *slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
172 (cont.) Seaman.	seepage	seepage *piping *excess sodium	soil blowing *slope *excess sodium
173 Yermo	seepage	seepage large stones excess sodium excess salt	large stones droughty excess salt excess sodium
174 Yermo, extremely gravelly.	seepage slope	*seepage *large stones	large stones droughty slope
Yermo, stony.	seepage slope	*seepage large stones	large stones droughty slope
175 Zono.	seepage depth to rock slope	thin layer seepage *piping	droughty fast intake soil blowing slope
176 Honova Variant.	depth to rock slope	thin layer seepage piping	droughty fast intake depth to rock slope

TABLE E -- WATER MANAGEMENT (Cont.)

Soil Name and Map Symbol	Pond Reservoir Area	Embankments, Dikes, and Levees	Irrigated Agriculture
177			
Yermo, extremely gravelly.	seepage slope	*seepage *large stones	large stones droughty slope
Yermo, stony.	seepage slope	*seepage large stones	large stones droughty slope
178			
Entic Durorthids. . . .	seepage cemented pan slope	thin layer *large stones	droughty cemented pan slope
Typic Durorthids. . . .	cemented pan slope	thin layer *large stones	droughty cemented pan slope

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

AGRICULTURAL POTENTIAL

Table F shows the mapping units in the inventory area with significant agricultural potential. Note that all of these soils need irrigation, due to the arid or semiarid climate. Near the turn of the century, northern Owens Valley and Round Valley produced apples, grapes, pears, wheat, barley, potatoes, alfalfa, melons, and silage corn. Livestock was also an important industry. These were produced on private lands, near or just above the valley floors. Most of the federal lands in the valleys are not on the valley floors, but are on the alluvial fans on the rims of the valleys. These lands commonly have very gravelly, stony, or bouldery soils that are not suitable for agriculture. The agriculture that remains today centers around alfalfa production. The possibility of late spring frosts is one of the major hazards to agriculture, along with the scarcity of irrigation water.

TABLE F -- SOIL MAPPING UNITS WITH SIGNIFICANT AGRICULTURAL POTENTIAL

Mapping Unit Number and Name	Slope %	Comments
112 Brantel gravelly loamy sand.	0 - 5	Needs sprinkler irrigation; sandy textures; moderate water holding capacity; high soil blowing hazard; short growing season.
115 Cajon gravelly loamy sand.	0 - 5	Needs sprinkler irrigation; sandy textures; low water holding capacity; moderate soil blowing hazard.
128 Hammil gravelly loamy sand.	0 - 5	Needs sprinkler irrigation; sandy textures; moderate water holding capacity; high soil blowing hazard.
132 Hoye Variant loam . . .	0 - 2	Needs irrigation; very slow permeability; moderate soil blowing hazard; some slightly saline-sodic areas.
145 Rovana gravelly loamy coarse sand	5 - 15	Needs sprinkler irrigation; sandy textures; low water holding capacity; moderate soil blowing hazard; short growing season.
146 Rovana loamy sand . . .	0 - 5	Needs sprinkler irrigation; sandy textures; low to moderate water holding capacity; high soil blowing hazard; short growing season.
147 Sawavu-Brantel complex.	2 - 9	Needs sprinkler irrigation; needs ripping (hardpan); sandy textures; moderate water holding capacity; high soil blowing hazard; short growing season.

TABLE F -- SOIL MAPPING UNITS WITH SIGNIFICANT AGRICULTURAL POTENTIAL (Cont.)

Mapping Unit Number and Name	Slope %	Comments
151 Thibau loamy coarse sand.	5 - 15	Needs sprinkler irrigation; sandy textures; low water holding capacity; moderate soil blowing hazard.
172 Yellowrock-Seaman complex	2 - 5	Needs sprinkler irrigation; low or moderate water holding capacity; moderate soil blowing hazard; slight substratum sodium toxicity.

RANGELAND IMPROVEMENT

Table G gives soil limitation ratings for some common rangeland improvement practices.

Rangeland seedings on depleted rangelands will result in decreased runoff and subsequent decrease in soil losses from erosion. The former will result in increased amounts of water available to plants for growth and maintenance of plant vigor while the latter will result in substantial reductions in sediment yield.

The soil suitability rating is intended to be a relative rating suggesting the proportion of successful seeding establishments that might be expected during a given period of years. In addition, the number of plant species adapted to the soil and its properties decreases with decreasing soil suitability. For example, successful seedings can be expected in 7 or more years out of 10 for a soil that is rated "good," and any one of several different plants may be successfully seeded. Successful seedings will result in about 5 years out of 10 for a soil that is rated "poor," and only the most drought tolerant plants can be seeded. A soil rated "very poor" should be considered for seeding only under emergency circumstances, such as after a fire to keep soil erosion losses to a minimum, because seeding success may only be as high as 3 years out of 10, but normally even less successful.

Also considered in rating a soil for rangeland seeding are machinery limitations that may result from soil properties, such as the presence of stones, rock outcrops, and excessive slope.

It is not the intent of the suitability rating to be a measure of the total annual yield, though in some instances it may be so. Productivity is dependent upon the interaction of almost all of the soil properties and qualities that are considered.

The soil will be rated fair, poor, or very poor by its most limiting property, even if only one such property exists.

Emergency rehabilitation seeding involves the aerial application of grass seed, with no mechanical incorporation of the seed into the soil. The main factors that can affect the sprouting and seedling survival are the native precipitation, surface texture, soil depth, excess salt or sodium, and water holding capacity of the soil. The soils are rated good, fair, or poor according to the proportion of successful seeding establishments that might be expected during a given period of years.

Tree planting is the establishment of trees and shrubs for landscaping purposes and does not take into account the climate of the area. Only soil physical and chemical properties are considered, and it is assumed that some source of irrigation water (whether natural or artificial) will be used. Of major importance are soil depth, soil textures, rock fragment content, and the presence of excess salts or sodium. The soils are given a slight, moderate, or severe rating based on these and other soil qualities.

Fencing is the construction and maintenance of wire barriers that restrict movement of livestock. The barriers are constructed of metal, or treated or untreated wooden posts buried at least two (2) feet into the soil with at least three (3) wires suspended between the post, but more commonly five (5) wires.

The ratings are based on the soil properties that influence ease of setting posts in the soil to the desired depth, maintaining the desired wire tension, and keeping replacement and maintenance cost to a minimum over the projected life of the fence. Excavations for wooden post holes are commonly made by power auger, while metal posts are hand-driven into the soil. Depth to bedrock and cemented pan, and large and small stones, influence the ease of excavation of post holes and driving posts. Flooding and depth to high water table may restrict the season in which the fence can be constructed. Flooding can also influence maintenance and replacement cost. Depth to high water can influence maintenance cost and require deeper post settings to offset the soil's low strength when saturated. Shrink-swell characteristics of the soil will require deeper post settings or rock-jacks to maintain vertical post alignment. Permanently frozen soil may lose its insulation qualities when setting posts and result in thermokarst topography. Post alignment and desired wire tension is often difficult to obtain on sandy soils due to their in-place low strength. Maintenance can also be a problem due to soil blowing. Frost action characteristics of the soil may result in frost-heaving of the posts. Slope influences the ease of using power augers and transport of supplies. It can also result in surface creep during wetter seasons such as the spring snow melt period. Soil reaction and salinity will influence the type of post used and maintenance cost due to corrosivity.

Soil map units that contain more than 10 percent rock outcrops are rated SEVERE.

TABLE G -- RANGELAND IMPROVEMENT

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
101				
Alamedawell	Poor: low precipitation sandy surface	Fair: low precipitation sandy surface droughty	Slight	Severe: too sandy
Deepwell.	Very Poor: sandy surface droughty	Poor: sandy surface droughty	Slight	Severe: too sandy
102				
Aquents	Poor: excess sodium *excess salt	Poor: excess sodium *excess salt	Severe: excess sodium *excess salt ponding wetness	Severe: wetness ponding excess salt
Aquic Torriorthents . .	Very Poor: *sandy surface *droughty excess sodium *excess salt	Poor: *sandy surface *droughty excess sodium *excess salt	Severe: excess sodium *excess salt	Slight to Moderate: excess salt
103				
Aquents	Poor: excess sodium *excess salt	Poor: excess sodium *excess salt	Severe: excess sodium *excess salt ponding wetness	Severe: wetness ponding excess salt
Aquic Torriorthents . .	Very Poor: *sandy surface *droughty excess sodium *excess salt	Poor: *sandy surface *droughty excess sodium *excess salt	Severe: excess sodium *excess salt	Slight to Moderate: excess salt

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
103 (cont.) Deepwell.	Very Poor: sandy surface droughty	Poor: sandy surface droughty	Slight	Severe: too sandy
104 Arizo	Very Poor: low precipitation sandy surface large stones droughty	Poor: low precipitation sandy surface droughty	Moderate to Severe: *large stones droughty	Severe: large stones
105 Arizo	Very Poor: low precipitation sandy surface *large stones droughty	Poor: low precipitation sandy surface droughty	Severe: droughty	Moderate to Severe: large stones too sandy
Yellowrock.	Very Poor: low precipitation sandy surface droughty	Poor: low precipitation sandy surface droughty	Moderate: droughty	Moderate: too sandy
106 Badland	Very Poor: low precipitation excess sodium *excess salt	Poor: low precipitation excess sodium *excess salt	Severe: excess sodium excess salt	Severe: slopes
107 Washoe.	Very Poor: sandy surface *large stones	Poor: sandy surface	Moderate to Severe: large stones	Severe: large stones

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
108 Washoe.	Very Poor: sandy surface	Poor: surface too sandy	Moderate: *large stones droughty	Moderate to Severe: large stones *too sandy
Washoe Variant.	Poor to Very Poor: sandy surface *droughty	Fair to Poor: sandy surface *droughty	Slight to Moderate: droughty	Slight
109 Berent family	Very Poor: sandy surface slope	Poor: sandy surface	Moderate: droughty	Moderate: too sandy
Glenbrook family. . . .	Very Poor: sandy surface depth to rock droughty slope	Poor: sandy surface depth to rock droughty	Severe: droughty	Moderate: depth to rock slope too sandy
110 Bitter.	Very Poor: low precipitation *sandy surface large stones	Poor: low precipitation *sandy surface	Moderate: large stones droughty	Moderate to Severe: large stones
Garlock Variant	Very Poor: low precipitation *sandy surface	Poor: low precipitation sandy surface	Slight to Moderate: droughty	Slight
111 Brantel	Very Poor: sandy surface	Fair to Poor: sandy surface	Moderate: droughty excessively drained	Severe: *too sandy

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
112 Brantel	Very Poor: low precipitation droughty	Fair: low precipitation droughty	Slight	Severe: too sandy
113 Brantel Variant	Very Poor: *sandy surface droughty	Poor: *sandy surface droughty	Severe: *small stones droughty	Severe: small stones too sandy
Brantel	Very Poor: sandy surface	Fair to Poor: low precipitation sandy surface	Moderate: droughty excessively drained	Severe: too sandy
114 Buscones.	Poor: low precipitation sandy surface depth to rock droughty	Fair: low precipitation sandy surface depth to rock droughty	Moderate: droughty	Severe: too sandy
115 Cajon	Very Poor: low precipitation sandy surface	Poor: low precipitation sandy surface	Moderate: droughty	Moderate: too sandy
116 Cashbaugh	Very Poor: depth to rock droughty	Poor: depth to rock droughty	Severe: *depth to rock droughty	Severe: depth to rock
Buscones.	Poor: sandy surface depth to rock droughty	Fair: sandy surface depth to rock droughty	Severe: droughty	Moderate: depth to rock too sandy

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
117 Cashbaugh	Very Poor: depth to rock droughty	Fair: depth to rock droughty	Severe: *depth to rock droughty	Severe: depth to rock
Brantel	Poor: low precipitation droughty	Fair: low precipitation droughty	Slight	Severe: too sandy
118 Chidago	Very Poor: low precipitation	Poor: low precipitation	Moderate: droughty	Moderate: too sandy
119 Cowtrack.	Poor: sandy surface slope	Fair to Poor: sandy surface droughty	Slight to Moderate: droughty	Severe: too sandy
120 Cowtrack Variant. . . .	Poor: *sandy surface	Poor: surface too sandy	Moderate: droughty	Severe: too sandy
121 Cryoborolls	Very Poor: *depth to rock droughty slope	Fair: *depth to rock droughty *slope	Moderate: small stones droughty	Moderate to Severe: *depth to rock small stones *slope
122 Cryoborolls	Very Poor: sandy surface *large stones *depth to rock *droughty slope	Poor to Fair: low precipitation *depth to rock droughty *slope	Moderate to Severe: *large stones depth to rock *droughty	Moderate to Severe: *depth to rock *large stones *slope

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
123 Durargids, shallow. . .	Very Poor: low precipitation surface too sandy cemented pan *droughty	Poor: low precipitation surface too sandy cemented pan *droughty	Severe: droughty *percs slowly	Severe: cemented pan *shrink-swell
124 Entic Durorthids. . . .	Very Poor: low precipitation small stones *droughty *slope	Poor: low precipitation *droughty	Severe: droughty	Moderate to Severe: small stones
Typic Durorthids. . . .	Very Poor: low precipitation cemented pan droughty	Poor: low precipitation cemented pan droughty	Severe: droughty	Severe: cemented pan
125 Pajuela	Very Poor: low precipitation surface too sandy large stones droughty	Poor: low precipitation surface too sandy droughty	Moderate to Severe: large stones droughty	Severe: large stones
126 Pajuela	Very Poor: low precipitation surface too sandy *large stones droughty	Poor: low precipitation surface too sandy droughty	Moderate to Severe: *large stones droughty	Moderate to Severe: large stones too sandy

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
126 (cont.) Thibau.	Very Poor: low precipitation surface too sandy	Poor: low precipitation surface too sandy	Moderate: droughty	Moderate: too sandy
127 Halloran Variant. . . .	Very Poor: low precipitation excess sodium *excess salt	Poor: low precipitation excess sodium excess salt	Severe: excess sodium	Slight to Moderate: excess salt
128 Hammil.	Very Poor: low precipitation	Poor: low precipitation	Moderate: droughty	Severe: too sandy
129 Haplargids, frigid. . .	Very Poor: *depth to rock droughty slope	Fair: *depth to rock droughty *slope	Moderate: small stones droughty	Moderate to Severe: depth to rock small stones *slope
Torriorthents, frigid .	Very Poor: *depth to rock droughty slope	Fair: *depth to rock droughty *slope	Moderate: small stones droughty	Moderate to Severe: depth to rock small stones *slope
130 Honova.	Very Poor: low precipitation surface too sandy depth to rock *small stones droughty	Poor: low precipitation surface too sandy depth to rock droughty	Severe: depth to rock droughty	Severe: depth to rock

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
131 Honova Variant.	Very Poor: low precipitation surface too sandy depth to rock droughty	Poor: low precipitation surface too sandy depth to rock droughty	Severe: depth to rock droughty	Severe: depth to rock
132 Hoye Variant.	Poor: low precipitation	Fair: low precipitation excess sodium	Moderate: percs slowly excess sodium	Slight
133 Wellington.	Very Poor: cemented pan	Poor: cemented pan	Severe: droughty	Severe: cemented pan
134 Wellington.	Very Poor: cemented pan	Poor: cemented pan	Severe: droughty	Severe: cemented pan
135 Lithic Torriorthents. .	Very Poor: low precipitation *small stones depth to rock droughty slope	Poor: low precipitation depth to rock droughty *slope	Severe: depth to rock droughty	Severe: depth to rock *small stones too rocky *slope
Lithic Haplargids . . .	Very Poor: low precipitation depth to rock *droughty slope	Poor: low precipitation depth to rock droughty *slope	Severe: depth to rock droughty	Severe: depth to rock too rocky *slope

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
136 Lithic Xerollic Haplargids.	Very Poor: depth to rock *droughty slope	Poor: depth to rock *droughty slope	Severe: depth to rock droughty	Severe: depth to rock too rocky *slope
Lithic Xeric Torriorthents	Very Poor: *small stones depth to rock droughty slope	Poor: depth to rock droughty slope	Severe: depth to rock droughty	Severe: depth to rock *small stones too rocky *slope
137 Haar family	Very Poor: sandy surface depth to rock droughty	Poor: sandy surface depth to rock droughty	Severe: depth to rock droughty	Moderate to Severe: depth to rock
138 Xeric Torriorthents, very bouldery	Very Poor: *sandy surface *large stones *depth to rock *droughty *slope	Poor: *sandy surface *depth to rock *droughty	Moderate: large stones depth to rock droughty	Severe: *depth to rock too rocky
139 Millner	Very Poor: low precipitation	Poor: low precipitation	Moderate: small stones droughty	Moderate to Severe: small stones

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
139 (cont.) Millner, stony.	Very Poor: low precipitation	Poor: low precipitation	Moderate: small stones droughty	Moderate to Severe: large stones small stones
140 Dotard.	Poor: low precipitation stones	Fair: low precipitation	Moderate: stones droughty	Moderate: small stones
141 Pizona.	Poor: sandy surface stones slope	Fair: precipitation sandy surface stones droughty *slope	Moderate: stones droughty *depth to rock	Moderate: large stones *too sandy rock outcrop
Brantel	Poor: sandy surface	Fair: low precipitation sandy surface	Slight to Moderate: droughty	Severe: too sandy
142 Avalmount	Poor: low precipitation stones *slope	Fair: low precipitation	Moderate: stones droughty	Moderate to Severe: large stones rock outcrop
143 Playa	Very Poor: *low precipitation droughty excess sodium excess salt	Poor: *low precipitation droughty excess sodium excess salt	Severe: soil reaction salinity droughty wetness excess sodium	Moderate: wetness excess salt

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
144 Rock Outcrop.	Very Poor: too rocky	Very Poor: too rocky	Severe: too rocky	Severe: too rocky
145 Rovana.	Very Poor: sandy surface	Poor: sandy surface	Moderate: droughty	Moderate: too sandy
146 Rovana.	Poor: low precipitation sandy surface	Fair: low precipitation sandy surface	Moderate: droughty	Moderate to Severe: too sandy
147 Sawavu.	Poor: low precipitation cemented pan *droughty	Fair: low precipitation cemented pan droughty	Moderate: cemented pan droughty	Severe: too sandy
Brantel	Poor: low precipitation	Fair: low precipitation	Moderate: droughty	Severe: too sandy
148 Sherwin	Very Poor: depth to rock droughty	Poor: depth to rock droughty	Severe: depth to rock droughty	Severe: depth to rock
149 Taboose	Very Poor: low precipitation	Poor: low precipitation	Moderate: stones droughty	Moderate to Severe: large stones rock outcrop
150 Taboose	Very Poor: low precipitation	Poor: low precipitation	Moderate: stones droughty	Moderate to Severe: large stones rock outcrop

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
151 Thibau.	Very Poor: low precipitation sandy surface	Poor: low precipitation sandy surface	Moderate: droughty	Moderate to Severe: too sandy
152 Thibau.	Very Poor: low precipitation sandy surface	Poor: low precipitation sandy surface	Moderate: droughty	Moderate to Severe: too sandy
153 Tinemaha.	Very Poor: low precipitation *sandy surface large stones	Poor: low precipitation *sandy surface	Moderate to Severe: large stones droughty	Severe: large stones
154 Tinemaha.	Very Poor: low precipitation *sandy surfaces *large stones	Poor: low precipitation *sandy surfaces	Moderate: *large stones droughty	Moderate to Severe: large stones
Lubkin.	Very Poor: low precipitation *sandy surface	Poor: low precipitation *sandy surface	Moderate: droughty	Slight
155 Xeralfic Haplargids, mesic	Very Poor: *sandy surface large stones *droughty	Poor: *sandy surface *droughty	Moderate to Severe: large stones droughty	Moderate to Severe: large stones

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
156 Lithic Xeric Torriorthents	Very Poor: depth to rock stones *droughty slope	Fair to Poor: low precipitation *droughty slope	Moderate to Severe: *stones depth to rock droughty	Moderate to Severe: *depth to rock small stones *slope
Buscones.	Poor to Very Poor: low precipitation droughty	Fair to Poor: low precipitation droughty	Moderate to Severe: depth to rock droughty	Severe: too sandy
157 Torriorthents, frigid .	Very Poor: sandy surface *large stones *droughty *slope	Poor: sandy surface *droughty	Moderate to Severe: soil depth *large stones	Severe: *large stones too rocky
Haplargids, frigid. . .	Very Poor: sandy surface *large stones *droughty *slope	Poor: sandy surface *droughty	Moderate to Severe: soil depth *large stones	Severe: *large stones too rocky
158 Torripsamments.	Very Poor: low precipitation too sandy droughty slope	Fair to Poor: low precipitation too sandy droughty slope	Moderate: droughty	Severe: too sandy
Cinder Land	Very Poor: *low precipitation small stones droughty slope	Very Poor: *low precipitation droughty	Severe: small stones droughty	Severe: small stones too sandy

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
159 Tuttle.	Very Poor: sandy surface large stones *droughty	Poor: sandy surface *droughty	Severe: *large stones droughty	Severe: large stones
160 Tuttle.	Very Poor: sandy surface large stones *droughty	Poor: sandy surface *droughty	Severe: *large stones droughty	Severe: large stones
161 Tuttle.	Very Poor: sandy surface *droughty	Poor: sandy surface *droughty	Severe: droughty	Moderate to Severe: large stones too sandy
Rovana.	Very Poor: sandy surface	Poor: sandy surface	Moderate: droughty	Moderate: too sandy
162 Tuttle.	Very Poor: sandy surface *droughty	Poor: sandy surface droughty	Severe: droughty	Moderate to Severe: large stones too sandy
Rovana.	Very Poor: sandy surface *droughty	Poor: sandy surface *droughty	Severe: droughty	Moderate: too sandy
163 Tuttle Variant.	Fair to Poor: low precipitation *stones droughty	Fair: low precipitation	Moderate: droughty	Moderate to Severe: small stones

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
164				
Victorville family. . .	Very Poor: low precipitation excess sodium excess salt	Poor: low precipitation excess sodium excess salt	Severe: excess sodium excess salt	Moderate: excess salt
Villa family.	Very Poor: low precipitation sandy surface	Poor: low precipitation sandy surface	Severe: excess sodium	Severe: too sandy
165				
Water	----------	----------	----------	----------
166				
Whitewolf family. . . .	Very Poor: low precipitation sandy surface *slope	Poor: low precipitation slope	Moderate to Severe: droughty depth to rock	Moderate to Severe: too sandy slope
Toquerville family. . .	Very Poor: low precipitation sandy surface depth to rock droughty *slope	Poor: low precipitation sandy surface depth to rock droughty	Severe: depth to rock droughty	Severe: depth to rock *too sandy *too rocky
167				
Xeric Torriorthents . .	Poor: low precipitation *droughty	Fair: low precipitation *droughty	Slight to Moderate: droughty	Slight
168				
Xeric Torriorthents, sodic	Very Poor: excess sodium	Poor: excess sodium	Severe: excess sodium	Slight to Moderate: excess salt

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
169 Xeric Torriorthents, ashy.	Very Poor: sandy surface	Poor: sandy surface	Moderate: droughty	Severe: too sandy
Durorthids, ashy. . . .	Very Poor: sandy surface *cemented pan *droughty	Poor: sandy surface *cemented pan *droughty	Severe: droughty *cemented pan	Severe: *cemented pan too sandy
170 Xerollic Durorthids . .	Very Poor: low precipitation sandy surface cemented pan *droughty	Poor: low precipitation sandy surface cemented pan droughty	Severe: droughty *cemented pan	Moderate to Severe: cemented pan too sandy
171 Yellowrock.	Very Poor: low precipitation sandy surface excess sodium excess salt	Poor: low precipitation sandy surface excess sodium excess salt	Severe: excess sodium	Severe: too sandy
172 Yellowrock.	Very Poor: low precipitation	Poor: low precipitation	Moderate: droughty *excess sodium	Moderate: too sandy *large stones
Seaman.	Very Poor: low precipitation	Poor: low precipitation	Slight to Moderate: droughty *excess sodium	Slight

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
173 Yermo	Very Poor: low precipitation stones *droughty excess sodium excess salt	Poor: low precipitation *droughty excess sodium excess salt	Severe: stones *excess salt excess sodium	Severe: small stones
174 Yermo, extremely gravelly.	Very Poor: low precipitation *stones *droughty	Poor: low precipitation *droughty	Moderate to Severe: stones droughty	Moderate to Severe: small stones
Yermo, stony.	Very Poor: low precipitation stones *droughty	Poor: low precipitation *droughty	Moderate to Severe: stones droughty	Moderate to Severe: large stones
175 Zono.	Poor to Very Poor: sandy surface *droughty slope	Fair: low precipitation sandy surface droughty	Moderate: droughty	Severe: too sandy
176 Honova Variant.	Very Poor: low precipitation sandy surface depth to rock droughty	Poor: low precipitation sandy surface depth to rock droughty	Severe: depth to rock droughty	Moderate to Severe: depth to rock too sandy

TABLE G -- RANGELAND IMPROVEMENT (Cont.)

Soil Name and Map Symbol	Range Seeding	Emergency Rehabilitation Seeding	Tree Planting	Fencing
177				
Yermo, extremely gravelly.	Very Poor: low precipitation *stones *droughty	Poor: low precipitation *droughty	Moderate to Severe: stones droughty	Moderate to Severe: small stones
Yermo, stony.	Very Poor: low precipitation stones *droughty	Poor: low precipitation *droughty	Moderate to Severe: stones droughty	Moderate to Severe: large stones
178				
Entic Durorthids. . . .	Very Poor: low precipitation small stones *droughty *slope	Poor: low precipitation *droughty	Severe: droughty	Moderate to Severe: small stones
Typic Durorthids. . . .	Very Poor: low precipitation cemented pan droughty	Poor: low precipitation cemented pan droughty	Severe: droughty	Severe: cemented pan

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

Rangeland Equipment Limitations

Table H shows ratings of some common rangeland equipment practices. This is a group of equipment usually identified by the "rangeland" name, but with application to a variety of situations. Most criteria are from the BLM handbook, but include some modifications. The interest is to confine the interpretations to the specific equipment.

The rangeland drill is used for seeding species suited for domestic livestock, wildlife, forage, and/or erosion control purposes, including slide trails, roadsides and other places. The ratings are intended to reflect equipment usage or ease of mechanical operation for the intended purpose of drilling seed into the soil. It assumes that species adapted to the conditions or site and dates of application are appropriate.

The rangeland disc plow is a specific type of disc plow designed for rugged use. It is used for site preparation, increasing infiltration and alleviating compaction in rangeland and forested areas.

Contour furrowing, subsoiling, pitting--these practices are for site preparation, increasing infiltration, increasing root penetration and alleviating compaction. Contour furrowing and pitting are more likely to be applied to range situations. Subsoiling may be applied to forested areas in skid trails, roads and landings, in addition to range uses.

Contour furrowing--this practice consists of more or less parallel furrows constructed on the contour. Furrows retain precipitation on-site, reduce runoff and sediment yield, increase soil moisture and vegetal cover. Closely spaced furrows, less than ten feet apart, increase the soil moisture over more of the area than do more widely spaced furrows. Life span of a furrowed system seldom exceeds 15 years due to sedimentation. However, this depends on the soil erodibility and frequency of high intensity storms.

Subsoiling--This practice is used to break up soil hardpans and other impermeable layers within the top 15 inches of the soil. Ripping increases moisture penetration, reduces surface runoff and erosion, enhances root development, and augments leaching of salts. Ripping should be performed on the contour and when the soil is dry. This practice is not adapted on steep slopes or where the soil is shallow over bedrock.

Pitting--Watershed tillage practice of pitting on rangelands consists of forming small basins or pits in soil at various spacings and intervals. Major objectives are to provide catchments for holding rain and runoff water, reducing erosion, increasing soil moisture for plant growth, and improving seedbed conditions where seeding is required.

Chaining pinyon-juniper lands is a method for uprooting the trees in order to increase range forage or wildlife habitat. Low stand densities and soil conditions in the Benton-Owens Valley area generally do not favor this practice. The only area that might profit from it is in the Inyo Mountains, and accessibility is a problem there.

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
101				
Alamedawell	Slight	Moderate: too sandy	Severe: too sandy	Severe: too sandy
Deepwell.	Slight	Moderate: too sandy	Severe: too sandy	----------
102				
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	----------
Aquic Torriorthents . .	Slight	Slight to Moderate: too sandy	Moderate to Severe: too sandy	----------
103				
Aquents	Severe: ponding wetness	Severe: ponding wetness	Severe: ponding wetness	----------
Aquic Torriorthents . .	Slight	Slight to Moderate: too sandy	Moderate to Severe: too sandy	----------
Deepwell.	Slight	Moderate: too sandy	Severe: too sandy	----------
104				
Arizo	Severe: large stones	Severe: large stones	Severe: large stones too sandy	----------
105				
Arizo	Moderate to Severe: large stones	Moderate to Severe: large stones	Severe: too sandy *large stones	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
105 (cont.)				
Yellowrock.	Slight to Moderate: large stones	Moderate: large stones	Severe: too sandy	----------
106				
Badland	Severe: slope	Severe: slope	Severe: slope	----------
107				
Washoe.	Severe: large stones	Severe: large stones	Severe: large stones *too sandy	Severe: *too sandy large stones
108				
Washoe.	Moderate to Severe: large stones	Moderate to Severe: large stones	Moderate to Severe: large stones too sandy	Severe: too sandy large stones
Washoe Variant.	Slight to Moderate: large stones	Slight to Moderate: large stones	Moderate to Severe: too sandy *large stones	Severe: too sandy *large stones
109				
Berent family	Severe: slope	Severe: slope	Severe: slope too sandy	Severe: too sandy slope
Glenbrook family. . . .	Severe: *large stones slope	Severe: *large stones slope	Severe: *large stones slope too sandy	Severe: too sandy slope
110				
Bitter.	Moderate: large stones	Moderate: large stones	Slight: *too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
110 (cont.)				
Garlock Variant	Slight to Moderate: large stones	Slight to Moderate: large stones	Slight to Severe: too sandy	----------
111				
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
112				
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
113				
Brantel Variant	Slight	Moderate: too sandy	Severe: too sandy	----------
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
114				
Buscones.	Slight	Moderate: too sandy	Severe: too sandy	Severe: slope too sandy
115				
Cajon	Slight	Slight	Severe: too sandy	----------
116				
Cashbaugh	Moderate to Severe: depth to rock	Severe: depth to rock	Severe: depth to rock rock outcrop too sandy	----------
Buscones.	Slight	Slight	Severe: too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
117 Cashbaugh	Moderate to Severe: depth to rock	Severe: depth to rock	Severe: depth to rock *rock outcrop too sandy	Severe: depth to rock too sandy
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
118 Chidago	Slight	Moderate: too sandy	Severe: too sandy	----------
119 Cowtrack.	Slight	Slopes 2 to 20 Percent Moderate: too sandy *slope Slopes 20 to 30 Percent Severe: slope	Severe: too sandy *slope	----------
120 Cowtrack Variant. . . .	Slight	Moderate: too sandy	Severe: too sandy	----------
121 Cryoborolls	Moderate to Severe: small stones slope	Moderate to Severe: small stones slope	Severe: *small stones rock outcrop slope	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
122 Cryoborolls	Severe: *large stones rock outcrop *slope	Severe: *large stones rock outcrop slope	Severe: *large stones rock outcrop slope too sandy	----------
123 Durargids, shallow. . .	Moderate: large stones	Moderate: large stones	Moderate: large stones too sandy	----------
124 Entic Durorthids. . . .	Moderate to Severe: small stones slope	Moderate to Severe: small stones slope	Severe: cemented pan *small stones *slope	----------
Typic Durorthids. . . .	Moderate to Severe: *cemented pan	Moderate to Severe: *cemented pan	Severe: cemented pan	----------
125 Pajuela	Severe: large stones	Severe: large stones	Severe: large stones too sandy	----------
126 Pajuela	Moderate to Severe: large stones	Moderate to Severe: large stones	Severe: *large stones too sandy	----------
Thibau.	Slight to Moderate: large stones	Slight to Moderate: large stones	Severe: too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
127 Halloran Variant. . . .	Slight	Slight	Moderate: too sandy	----------
128 Hammil.	Slight	Moderate: too sandy	Severe: too sandy	----------
129 Haplargids, frigid. . .	Moderate to Severe: *small stones slope *rock outcrop	Moderate to Severe: *small stones slope *rock outcrop	Severe: *small stones rock outcrop slope	Slopes 15 to 30 Percent Moderate to Severe: slope *depth to rock Slopes 30 to 50 Percent Severe: slope
Torriorthents, frigid .	Moderate to Severe: *small stones slope *rock outcrop	Moderate to Severe: *small stones slope *rock outcrop	Severe: *small stones rock outcrop slope	Slopes 15 to 30 Percent Moderate to Severe: slope *depth to rock Slopes 30 to 50 Percent Severe: slope
130 Honova.	Severe: depth to rock *large stones	Severe: depth to rock *large stones	Severe: depth to rock *large stones rock outcrop	----------
131 Honova Variant.	Moderate to Severe: depth to rock *rock outcrop	Moderate to Severe: depth to rock *rock outcrop	Severe: depth to rock *rock outcrop too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
132 Hoye Variant.	Slight	Slight	Slight	----------
133 Wellington.	Slight	Moderate: cemented pan	Severe: cemented pan	----------
134 Wellington.	Moderate: large stones	Moderate: cemented pan large stones	Severe: cemented pan	----------
135 Lithic Torriorthents. .	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	----------
Lithic Haplargids . . .	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	----------
136 Lithic Xerollic Haplargids.	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *rock outcrop slope

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
136 (cont.) Lithic Xeric Torriorthents	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *small stones rock outcrop slope	Severe: *depth to rock *rock outcrop slope
137 Haar family	Moderate to Severe: depth to rock *rock outcrop	Moderate to Severe: depth to rock *rock outcrop	Severe: depth to rock rock outcrop	Severe: *depth to rock too sandy
138 Xeric Torriorthents, very bouldery	Severe: *depth to rock large stones rock outcrop *slope	Severe: *depth to rock *large stones rock outcrop slope	Severe: *depth to rock *large stones rock outcrop slope *too sandy	Severe: *depth to rock *too sandy large stones *rock outcrop *slope
139 Millner	Moderate to Severe: small stones	Moderate to Severe: small stones	Moderate to Severe: small stones *slope too sandy	----------
Millner, stony.	Moderate to Severe: large stones small stones	Moderate to Severe: large stones small stones	Moderate to Severe: small stones large stones *slope too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
140 Dotard.	Moderate to Severe: small stones	Moderate to Severe: small stones	Moderate to Severe: small stones	----------
141 Pizona.	Moderate to Severe: large stones slope *rock outcrop	Severe: *large stones slope	Severe: *large stones slope	Severe: too sandy large stones *slope
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
142 Avalmount	Moderate to Severe: large stones *rock outcrop *slope	Moderate to Severe: large stones *slope *rock outcrop	Severe: *large stones rock outcrop *slope	----------
143 Playa	Severe: wetness	Severe: wetness	Severe: wetness	----------
144 Rock Outcrop.	Very Severe: rock outcrop slope	Very Severe: rock outcrop slope	Very Severe: rock outcrop slope	----------
145 Rovana.	Slight	Slight to Moderate: too sandy	Severe: too sandy	----------
146 Rovana.	Slight	Slight to Moderate: too sandy	Severe: too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
147 Sawavu.	Slight	Moderate: too sandy	Severe: too sandy	----------
Brantel	Slight	Moderate: too sandy	Severe: too sandy	----------
148 Sherwin	Severe: depth to rock large stones	Severe: depth to rock large stones	Severe: depth to rock large stones rock outcrop	Severe: depth to rock large stones
149 Taboose	Moderate to Severe: small stones *rock outcrop *slope	Moderate to Severe: small stones *slope *rock outcrop	Severe: *small stones rock outcrop	----------
150 Taboose	Moderate to Severe: small stones *rock outcrop	Moderate to Severe: small stones *rock outcrop	Severe: *small stones rock outcrop	----------
151 Thibau.	Slight	Moderate: too sandy	Severe: too sandy	----------
152 Thibau.	Slight	Severe: slope	Severe: slope *too sandy	----------
153 Tinemaha.	Severe: large stones	Severe: large stones	Severe: large stones too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
154				
Tinemaha.	Moderate to Severe: large stones	Moderate to Severe: large stones	Severe: too sandy	----------
Lubkin.	Slight to Moderate: large stones	Moderate: *large stones	Severe: too sandy	----------
155				
Xeralfic Haplargids, mesic	Moderate to Severe: large stones	Moderate to Severe: large stones *slope	Severe: *large stones *slope *too sandy	----------
156				
Lithic Xeric Torriorthents	Severe: *depth to rock *large stones *slope	Severe: *depth to rock *large stones slope	Severe: *depth to rock *large stones *rock outcrop slope	Severe: *depth to rock *large stones *slope
Buscones.	Moderate: slope	Severe: *slope too sandy	Severe: slope too sandy	Severe: too sandy slope
157				
Torriorthents, frigid .	Severe: *large stones rock outcrop *slope	Severe: *large stones rock outcrop slope	Severe: *depth to rock *large stones rock outcrop slope too sandy	Severe: too sandy *large stones *rock outcrop *slope

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
157 (cont.) Haplargids, frigid. . .	Severe: *large stones rock outcrop *slope	Severe: *large stones rock outcrop slope	Severe: *depth to rock *large stones rock outcrop slope too sandy	Severe: too sandy *large stones *rock outcrop *slope
158 Torripsamments.	Slopes 15 to 30 Percent Moderate: slope Slopes 30 to 50 Percent Severe: slope	Severe: slope	Severe: slope too sandy	----------
Cinder Land	Severe: small stones slope	Severe: small stones slope	Severe: small stones slope	----------
159 Tuttle.	Severe: large stones	Severe: large stones	Severe: large stones too sandy	----------
160 Tuttle.	Severe: large stones	Severe: large stones	Severe: large stones too sandy	----------
161 Tuttle.	Moderate to Severe: large stones	Moderate to Severe: large stones	Severe: too sandy	----------
Rovana.	Slight to Moderate: large stones	Slight to Moderate: large stones	Severe: too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
162				
Tuttle.	Moderate to Severe: large stones	Moderate to Severe: large stones	Severe: too sandy	----------
Rovana.	Slight to Moderate: large stones	Slight to Moderate: large stones	Severe: too sandy	----------
163				
Tuttle Variant.	Moderate: *large stones *small stones	Moderate: *large stones *small stones	Moderate: *large stones *small stones too sandy	----------
164				
Victorville family. . .	Slight	Slight	Slight	----------
Villa family.	Slight	Moderate: too sandy	Severe: too sandy	----------
165				
Water.	----------	----------	----------	----------
166				
Whitewolf family. . . .	Slopes 15 to 30 Percent Moderate: slope Slopes 30 to 50 Percent Severe: slope	Severe: slope	Severe: slope too sandy	----------
Toquerville family. . .	Moderate to Severe: depth to rock slope rock outcrop	Severe: *depth to rock *slope	Severe: depth to rock rock outcrop slope *too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
167 Xeric Torriorthents . .	Slight	Slight	Moderate: *slope too sandy	----------
168 Xeric Torriorthents, sodic	Slight	Slight	Slight	----------
169 Xeric Torriorthents, ashy.	Slight	Moderate: too sandy	Severe: too sandy	----------
Durorthids, ashy. . . .	Slight to Severe: cemented pan	Slight to Severe: cemented pan	Severe: *cemented pan too sandy	----------
170 Xerollic Durorthids . .	Slight	Slight	Severe: *cemented pan too sandy	----------
171 Yellowrock.	Slight	Moderate: too sandy	Severe: too sandy	----------
172 Yellowrock.	Slight	Slight	Severe: too sandy	----------
Seaman.	Slight	Slight	Moderate: too sandy	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
173 Yermo	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones	----------
174 Yermo, extremely gravelly.	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones *large stones	----------
Yermo, stony.	Severe: *large stones *small stones	Severe: *large stones *small stones	Severe: *large stones *small stones	----------
175 Zono.	Slopes 15 to 30 Percent Moderate: slope Slopes 30 to 50 Percent Severe: slope	Severe: slope	Severe: slope too sandy	----------
176 Honova Variant.	Severe: *depth to rock rock outcrop	Severe: *depth to rock rock outcrop	Severe: depth to rock rock outcrop too sandy	----------
177 Yermo, extremely gravelly.	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones *large stones	Moderate to Severe: small stones *large stones	----------

TABLE H -- RANGELAND EQUIPMENT LIMITATIONS (Cont.)

Soil Name and Map Symbol	Rangeland Drill	Rangeland Disc Plow	Contour Furrowing, Subsoiling, Pitting	Chaining Pinyon-Juniper Lands
177 (cont.)				
Yermo, stony.	Severe: *large stones *small stones	Severe: *large stones *small stones	Severe: *large stones *small stones	----------
178				
Entic Durorthids. . . .	Moderate to Severe: small stones slope	Moderate to Severe: small stones slope	Severe: cemented pan *small stones *slope	----------
Typic Durorthids. . . .	Moderate to Severe: cemented pan	Moderate to Severe: cemented pan	Severe: cemented pan	----------

* Limitation applies to a part of the mapping unit only. Due to variable soil properties at this higher category and the limited number of pedons observed.

SOIL PROPERTIES

Extensive data about soil properties collected during the soil inventory are summarized on the following pages. The two main sources of these data are the many hundreds of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soils in the inventory area, but laboratory data for many of the soils are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classfications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering Index Properties

Table I gives estimates of engineering properties and classifications for the major horizons of each soil in the inventory area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil in "Soil Technical Descriptions."

Texture is described in Table I in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (1) and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO) (2). In Table I soils in the inventory area are classified according to both systems.

The USCS system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic matter content. Soils are grouped into 15 classes--eight classes of coarse-grained soils, indentified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

Percentage of the soil material less than 3 inches in diameter that passes each of four standards sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the inventory area and in nearby areas and on field estimates from many borings made during the inventory.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the USCS and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

TABLE I -- ENGINEERING INDEX PROPERTIES

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments > 3 Inches	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO		4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
101											
Alamedawell	0-32	LS	SM	A-2	0	90-100	85-100	65-90	15-35	-----	NP
	32-60	SR-L, SIL, S	CL, ML	A-4, A-6	0	100	100	85-100	60-95	25-40	5-15
Deepwell.	0-60	FS, S	SW-SM, SM	A-3, A-1	0	100	100	50-80	5-20	-----	NP
102											
Aquents	0-9	SL, L, LS	SM	A-2	0	95-100	90-100	55-80	25-40	< 25	NP-5
	9-60	SR-COS, LS, SL, SIL, SICL	SM, ML-CL, CL	A-1, A-2, A-4, A-6	0	95-100	90-100	45-100	5-95	< 50	NP-20
Aquic Torriorthents . .	0-23	L, S, SL, LS	SM	A-1, A-2, A-4	0	95-100	80-100	45-90	5-70	< 40	NP-10
	23-60	SR-SIL, SL, COS, LS, GR-S	SM, ML-CL, CL	A-1, A-2, A-4	0	95-100	80-100	45-100	5-90	< 40	NP-10
103											
Aquents	0-9	SL, L, LS	SM	A-2	0	95-100	90-100	55-80	25-40	< 25	NP-5
	9-60	SR-COS, LS, SL, SIL, SICL	SM, ML-CL, CL	A-1, A-2, A-4, A-6	0	95-100	90-100	45-100	5-95	< 50	NP-20
Aquic Torriorthents . .	0-23	L, S, SL, LS	SM	A-1, A-2, A-4	0	95-100	80-100	45-90	5-70	< 40	NP-10
	23-60	SR-SIL, SL, COS, LS, GR-S	SM, ML-CL, CL	A-1, A-2, A-4	0	95-100	80-100	45-100	5-90	< 40	NP-10
Deepwell.	0-60	FS, S	SW-SM, SM	A-3, A-1	0	100	100	50-80	5-20	-----	NP
104											
Arizo	0-10	BYV-LCOS	SM	A-1, A-2	20-70	80-95	60-90	35-70	15-25	-----	NP
	10-60	STV-LCOS, STX-LCOS	SM	A-1, A-2,	30-80	80-95	55-90	30-70	10-25	-----	NP
105											
Arizo	0-10	BY-LCOS	SM	A-1, A-2	5-35	80-95	55-90	30-70	10-25	-----	NP
	10-60	STV-LCOS, STX-LCOS	SM	A-1, A-2,	30-80	80-95	55-90	30-70	10-25	-----	NP
Yellowrock.	0-10	GR-LCOS	SM	A-1, A-2	2-20	80-95	55-90	30-70	10-25	-----	NP
	10-60	GR-LCOS, CB-LCOS	SM	A-1, A-2,	5-30	80-95	55-80	30-60	10-20	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
106											
Badland	0-60	SR-SIL, SICL	ML-CL, CL	A-4, A-6, A-7	0	0	100	90-100	70-90	25-50	5-20
107											
Washoe.	0-20	BYV-LCOS	SM	A-1, A-2	30-70	80-95	60-85	35-70	15-25	-----	NP
	20-44	STV-SL, STV-SCL	SM-SC, SC	A-2, A-4, 4-6	30-75	75-95	55-80	40-70	15-40	20-40	5-15
	44-60	STV-LCOS	SM	A-1, A-2	30-75	75-95	55-80	30-60	10-25	-----	NP
108											
Washoe.	0-20	BY-LCOS	SM	A-1, A-2	5-35	75-95	55-90	30-70	10-25	-----	NP
	20-44	STV-SL, STV-SCL	SM-SC, SC	A-2, A-4, 4-6	30-75	75-95	55-80	40-70	15-35	20-40	5-15
	44-60	STV-LCOS	SM	A-1, A-2	30-75	75-95	55-80	30-60	10-25	-----	NP
Washoe Variant.	0-12	GR-LCOS, GR-SL	SM	A-1, A-2	2-20	75-95	55-90	30-75	10-30	<25	NP-5
	12-41	GR-SCL, CB-SCL	SM-SC, SC	A-2, A-4, 4-6	10-40	75-95	55-90	40-80	15-40	20-40	5-15
	41-60	CBV-SL, STV-SL	SM	A-1, A-2	30-65	75-95	55-85	35-70	15-30	<25	NP-5
109											
Berent family[1].	0-26	GR-LCOS	SM	A-1, A-2	0-10	85-95	70-90	40-70	15-25	-----	NP
	26-60	GR-LCOS, CB-LCOS	SM	A-1, A-2	15-30	85-95	70-90	40-70	15-25	-----	NP
Glenbrook family. . . .	0-11	BY-LCOS, ST-LCOS, GR-LCOS	SM	A-1, A-2	5-30	75-95	55-90	30-70	10-25	-----	NP
	11+	WB									
110											
Bitter.	0-8	BY-LCOS	SM	A-1, A-2	5-30	80-95	60-85	30-65	15-25	-----	NP
	8-30	GRV-SL, CBV-SL, GRV-SCL, CBV-SCL	SM-SC, SC	A-2, A-4, A-6	30-75	80-95	60-85	45-75	20-45	20-40	5-15
	30-60	CBV-SL	SM	A-1, A-2	30-75	80-95	60-85	30-70	15-30	<25	NP-5
Garlock Variant	0-6	GR-LCOS, GR-SL	SM	A-1, A-2	0-20	80-95	55-90	30-70	10-30	<25	NP-5
	6-27	GR-SCL	SC	A-6	0-20	80-95	60-90	50-80	20-45	30-40	10-15
	27-60	ST-SL	SM	A-1, A-2	10-35	80-95	55-90	30-70	10-30	<25	NP-5

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments > 3 Inches	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO		4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
111											
Brantel	0-60	GR-COS, COS	SW-SM, SM	A-1, A-2	0	65-100	50-95	25-75	0-25	-----	NP
112											
Brantel	0-32	LS	SM	A-2	0	85-100	75-95	50-75	20-30	-----	NP
	32-60	LS, GR-S	SM, SW-SM	A-2, A-1	0	60-100	50-95	30-75	5-30	-----	NP
113											
Brantel Variant	0-9	GR-S, LS	SW, SW-SM, SM	A-1, A-2, A-3	0-10	65-100	55-100	25-80	0-30	-----	NP
	9-60	GRX-COS	SW, GW	A-1	10-30	30-60	20-50	10-35	0-5	-----	NP
Brantel	0-60	GR-COS, COS	SM, SW-SM,	A-1, A-2	0-10	70-100	50-90	25-70	5-25	-----	NP
114											
Buscones.	0-1	GRV-LS	SM, SW-SM	A-1, A-2	0	55-100	35-85	25-70	10-25	-----	NP
	1-18	LS	SM	A-2	0	80-100	75-95	40-75	15-30	-----	NP
	18-31	GR-LS	SM, SW-SM	A-2, A-1	0	60-100	55-95	30-75	10-30	-----	NP
	31+	WB									
115											
Cajon	0-35	GR-LCOS	SM	A-2, A-1	0-10	70-95	50-85	30-70	10-25	-----	NP
	35-60	GR-COS	SW-SM, SM	A-1, A-2	0-10	70-95	50-85	25-70	5-25	-----	NP
116											
Cashbaugh	0-10	GR-LS, LS	SM	A-2	0-5	85-100	75-90	50-75	20-30	-----	NP
	10+	UWB									
Buscones.	0-26	GR-LS, LS	SM	A-2	0-5	85-100	75-90	50-75	20-25	-----	NP
	26+	UWB	SM	A-2, A-1	0-5	65-95	60-90	40-70	10-25	-----	NP
117											
Cashbaugh	0-17	GR-LS, LS	SM	A-2	0	90-100	75-95	55-75	15-30	-----	NP
	17+	UWB									
Brantel	0-60	LS	SM	A-2	0	85-100	75-90	50-70	15-25	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
118											
Chidago	0-36	LS	SM	A-2	0	85-100	70-95	55-75	15-30	-----	NP
	36+	WB									
119											
Cowtrack.	0-34	LS	SM	A-2	0	95-100	90-100	70-80	20-30	-----	NP
	34-50	SL, L, SCL	SC, SM-SC, ML-CL	A-4, A-6	5-10	85-100	75-95	60-85	30-70	25-40	10-20
	50-58	WB									
	58+	UWB									
120											
Cowtrack Variant. . . .	0-13	LCOS	SM	A-2, A-1	0	85-100	75-90	40-70	15-25	-----	NP
	13-60	SR-LS, GR-LCOS, GR-COS	SW-SM, SM	A-1, A-2	0	60-85	50-75	25-55	5-20	-----	NP
121											
Cryoborolls[1].	0-11	GRV-SL, GR-SL	SM, SM-SC	A-1, A-2	0-10	65-80	45-70	30-60	15-35	15-30	NP-10
	11-20	GRV-SL, GRV-SCL, GR-SL	GM-GC, GC, SM-SC, SC	A-2, A-4, A-6	0-30	50-80	25-70	20-65	10-40	20-40	5-20
	20+	UWB									
122											
Cryoborolls[1].	0-17	ST-LCOS, STV-COSL, BY-LCOS, BYV-COSL	SM, SW-SM	A-2	15-70	80-100	50-90	30-75	10-35	<25	NP-5
	17+	WB									
123											
Durargids, shallow. . .	0-2	LCOS, GR-LCOS	SM	A-2, A-1	2-15	85-95	55-90	40-70	15-25	-----	NP
	2-5	SL, GR-SL	SM, SM-SC	A-2	2-15	85-95	60-90	45-75	20-35	15-30	NP-10
	5-19	C, CL, SCL, SL	SC, CL, CH	A-6, A-7	0-5	90-100	80-90	65-85	35-65	30-60	10-35
	19-54	IND	-----	-----	-----	-----	-----	-----	-----	-----	-----
	54-60	COS	SW-SM, SM	A-1, A-3	2-10	85-95	75-90	45-65	5-15	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments > 3 Inches	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO		4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
124											
Entic Durorthids. . . .	0-1	GRV-SL, GRX-SL	GM-GC, GW-GM	A-1	10-30	35-70	15-50	10-45	5-25	20-30	5-10
	1-15	GR-SL	GM-GC, SM-SC	A-2	10-30	50-85	30-75	25-65	15-35	20-30	5-10
	15-40	GRV-SL, IND	GM-GC	A-2, A-1	10-30	50-65	30-50	25-45	15-25	20-30	5-10
	40-60	GRX-SL, GRX-LS	GM-GC, GM	A-2, A-1	10-30	50-65	25-50	20-40	10-25	<25	NP-10
Typic Durorthids. . . .	0-1	GRV-SL, GRX-SL	GM-GC, GW-GM	A-1	10-30	35-70	15-50	10-45	5-25	20-30	5-10
	1-5	GR-SL, SL	SM-SC	A-2, A-4	2-30	65-90	50-85	45-75	20-40	20-30	5-10
	5-17	IND	-----	-----	-----	-----	-----	-----	-----	-----	-----
	20-60	GRV-SL, GRX-SL	GM-GC, GM	A-2, A-1	10-30	50-65	25-50	20-40	10-25	<25	NP-10
125											
Pajuela	0-12	BYV-LCOS	SM	A-1, A-2	25-75	80-95	55-90	30-70	10-25	-----	NP
	12-60	STV-LCOS, CBV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-90	30-70	10-25	-----	NP
126											
Pajuela	0-12	BY-LCOS	SM	A-1, A-2	5-35	80-95	55-85	30-65	10-25	-----	NP
	12-60	STV-LCOS, CBV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-85	30-65	10-25	-----	NP
Thibau.	0-60	GR-LCOS, LCOS	SM	A-1, A-2	0-30	80-95	60-85	35-65	15-25	-----	NP
127											
Halloran Variant. . . .	0-1	GRV-S	SM, SW-SM	A-1, A-2	5-10	65-95	30-60	20-55	10-30	<25	NP-5
	1-8	SL	SM	A-2, A-4	5-10	90-100	80-100	65-85	25-45	<25	NP-5
	8-23	SL	SM-SC	A-2, A-4	0	90-100	80-90	70-80	30-45	20-30	5-10
	23-41	LS	SM	A-1, A-2	0-10	55-95	50-90	40-75	10-25	-----	NP
	41+	IND									
128											
Hammil.	0-60	LS	SM	A-2, A-1	0-5	80-100	60-90	40-75	15-25	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
129											
Haplargids, frigid[1] . .	0-1	GRV-SL, GRX-SL	GW-GM, GM-GC	A-1, A-2	0-15	40-80	15-50	10-55	5-30	<35	NP-10
	1-2	GR-SL, GRV-SL	SM, SM-SC	A-2	0-15	70-85	55-80	45-70	20-50	<35	NP-10
	2-13	GR-SL, GR-SCL, GRV-SL GRV-SCL	GC, SC	A-6	0-30	50-80	25-70	20-65	10-50	30-40	10-20
	13+	UWB									
Torriorthents, frigid[1].	0-1	GRV-SL, GRX-SL	GW-GM, GM-GC	A-1, A-2	0-15	40-80	15-50	10-55	5-30	<35	NP-10
	1-45	GR-SL, GRV-SL	SM, SM-SC	A-2	0-15	70-85	55-80	45-70	20-50	<35	NP-10
	45+	UWB									
130											
Honova.	0-3	CBV-LS	SM, SW-SM	A-2, A-1	25-50	60-80	55-75	40-75	10-25	-----	NP
	3-7	SL, GR-SL	SM, SM-SC	A-2, A-4	5-20	75-100	65-90	50-75	20-45	<30	NP-10
	7+	UWB									
131											
Honova Variant.	0-6	LCOS	SM	A-2	0-5	85-100	75-90	55-75	15-25	-----	NP
	6+										
132											
Hoye Variant.	0-7	L	ML-CL, CL, SM-SC	A-4, A-6	0	100	100	80-95	40-75	20-40	5-15
	7-21	L, SICL	CL	A-6, A-7	0	100	100	95-100	85-90	35-50	10-20
	21-31	C	CH	A-7	0	100	100	90-95	70-85	45-65	25-35
	31-60	SIL	ML-CL	A-4	0	100	100	90-95	70-85	20-40	5-10
133											
Wellington.	0-1	GRV-LS	SM, SW-SM	A-1, A-2	0-10	65-85	35-70	25-60	5-20	-----	NP
	1-5	LS	SM	A-2	0-10	85-95	75-90	55-80	15-30	-----	NP
	5-13	SCL, L	SC, CL	A-6	0-10	85-95	80-90	65-85	40-60	30-40	10-15
	13+	IND									

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments > 3 Inches	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO		4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
134											
Wellington.	0-1	GRV-LS	SM, SW-SM	A-1, A-2	5-25	65-85	40-70	30-60	5-20	-----	NP
	1-7	LS	SM	A-2	5-25	85-95	75-90	55-80	15-30	-----	NP
	7-15	SCL	SC, CL	A-6	0-15	85-95	80-90	65-85	40-60	30-40	10-15
	15	IND									
135											
Lithic Torriorthents. .	0-1	GRV-SL, GRV-SIL, GRX-SL, GRX-SIL	GM-GC, GW-GM, GM	A-1	5-30	35-75	15-55	12-50	5-30	<25	NP-5
	1-5	GR-SL, GR-SIL, GRV-SL, GRV-SIL	SM, GM, GW-GM	A-1, A-2, A-4	5-30	55-90	40-80	30-75	10-55	<25	NP-5
	5	UWB									
Lithic Haplargids . . .	0-1	GRV-SL, GRV-SIL, GRX-SL, GRX-SIL	GW-GM, GM-GC, GM	A-1	0-25	35-75	15-55	12-50	5-30	<30	NP-10
	1-4	GR-SL, GR-SIL	ML, SM-SC, SM	A-1, A-2, A-4	0-25	65-90	50-85	35-80	15-65	<30	NP-10
	4-11	GR-SICL, GR-SCL, GRV-SICL, GRV-SCL	CL, SC, GC	A-6, A-7	0-25	65-90	50-85	40-85	20-75	30-50	10-20
	11	UWB									
136											
Lithic Xerollic Haplargids.	0-1	GRV-SL, GRV-L, GRX-SL, GRX-L	GW-GM, GM-GC, GM	A-1	0-25	35-75	15-55	12-50	5-30	<30	NP-10
	1-3	GRV-SL, GRV-L	SM	A-1, A-2, A-4	0-25	65-90	50-80	40-70	15-40	<30	NP-10
	3-12	GR-SICL, GR-SCL, CB-SCL, GRV-SICL	SC, CL, GC	A-6	0-40	60-90	40-80	35-70	15-65	30-40	10-20
	12	UWB									
Lithic Xeric Torriorthents	0-1	GRV-SL, GRX-SL,	GW-GM, GM-GC, GM	A-1	0-25	35-75	15-55	12-50	5-30	<30	NP-10
	1-3	GR-SL, GR-L	SM, SM-SC, ML	A-1, A-2, A-4	0-25	55-85	30-80	25-75	10-55	<30	NP-10
	3-13	GR-SL, GRV-SL	GM, SM, SM-SC	A-1, A-2, A-4	0-30	50-80	30-70	25-65	10-45	<30	NP-10
	13	UWB									

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
137											
Haar family	0-2	GR-LCOS	SM	A-1, A-2	0-10	85-100	70-90	40-70	15-25	-----	NP
	2-5	COSL	SM	A-2, A-4	0-10	90-100	75-95	55-80	20-45	<25	NP-5
	5	WB									
138											
Xeric Torriorthents,[1]											
very bouldery	0-9	BYV-COSL, BYV-LCOS	SM	A-2, A-1	10-50	85-100	60-90	35-75	10-35	<25	NP-5
	9	WB									
139											
Millner	0-1	GRV-SL	GM, SM, GW-GM	A-1, A-2	0-30	45-80	30-55	20-50	10-30	<25	NP-5
	1-8	GR-SL	GM, SM	A-1, A-2, A-4	0-30	50-90	35-85	25-75	10-45	<25	NP-5
	8-33	GRV-FSL	GM, GW-GM	A-1, A-2, A-4	5-45	45-85	30-80	25-75	10-45	<25	NP-5
	33-60	SR-CB-SL, SL	GM, GW-GM	A-1, A-2, A-4	5-45	45-95	30-90	25-80	10-50	<25	NP-5
Millner, stony.	0-8	ST-SL	GM, SM	A-1, A-2, A-4	5-40	50-90	35-85	25-75	10-45	<25	NP-5
	8-60	CBV-SL	GM, GW-GM	A-1, A-2, A-4	5-45	45-95	30-80	25-75	10-45	<25	NP-5
140											
Dotard.	0-1	GRV-SL	GM, GW-GM	A-1	0-5	50-60	30-50	20-45	10-25	15-25	NP-5
	1-3	GR-SL	SM	A-2, A-4	5-20	70-90	60-85	45-75	20-40	15-25	NP-5
	3-60	CBV-FSL	GM	A-1, A-2	15-45	55-75	35-60	30-55	15-35	15-25	NP-5
141											
Pizona.	0-11	ST-LS	SM	A-2	10-45	80-95	70-90	50-65	15-25	-----	NP
	11-17	CB-SL	SM, SM-SC	A-2	10-45	65-90	60-80	45-70	15-35	<25	NP-10
	17-44	CBV-SCL, CBV-SL	SC, SM-SC	A-6, A-2, A-4	30-55	60-90	55-80	45-75	20-45	20-40	5-20
	44	UWB									
Brantel	0-60	LS, GR-S	SM, SW-SM	A-2, A-1	0-5	75-100	50-95	35-75	5-30	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO	>3 Inches	4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
142 Avalmount	0-10	GRV-FSL	GM	A-2, A-4, A-1	10-40	60-80	40-70	30-60	15-40	<25	NP-5
	10-30	CBV-L	GM, GM-GC	A-2, A-4, A-1	40-55	60-80	45-70	40-65	25-45	<35	NP-10
	30-60	STX-VFSL	GM, GM-GC	A-2, A-4, A-1	55-70	60-80	45-70	40-65	20-45	<35	NP-10
143 Playa	0-60	SR-S, LS, SL, SIL	SM, ML, ML-CL	A-3, A-2, A-4	0	100	95-100	70-95	15-80	<35	NP-10
144 Rock Outcrop	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
145 Rovana	0-60	GR-LCOS, LCOS	SM, SW-SM	A-1, A-2	0-15	80-100	50-90	25-70	5-30	-----	NP
146 Rovana	0-10	LS	SM, SW-SM	A-1, A-2	0-10	85-100	55-75	40-65	5-25	-----	NP
	10-60	GR-LCOS, LCOS	SM, SW-SM	A-1, A-2	0-10	80-100	50-90	25-70	5-30	-----	NP
147 Sawavu	0-24	LS	SM	A-2	0-5	85-100	75-95	55-80	15-30	-----	NP
	24-50	LS, IND	SM, SW-SM	A-2, A-1	0-5	60-100	50-90	35-80	10-30	-----	NP
	50-60	LS, GR-LS	SM, SW-SM	A-2, A-1	0-25	60-100	50-90	35-80	10-30	-----	NP
Brantel	0-32	LS	SM	A-2	0	85-100	75-95	50-75	20-30	-----	NP
	32-60	LS, GR-S	SM, SW-SM	A-2, A-1	0	60-100	50-95	30-75	5-30	-----	NP
148 Sherwin	0-3	CBV-LFS	SM, SW-SM	A-2, A-1	25-50	60-95	55-90	45-75	10-30	-----	NP
	3-7	SL, GR-SL	SM, SM-SC	A-2, A-4	5-20	75-100	60-90	45-75	20-45	<30	NP-10
	7	UWB									
149 Taboose	0-5	GRV-LFS	GM	A-1, A-2	20-35	60-80	40-70	30-65	10-25	-----	NP
	5-25	GR-FSL	SM	A-2	10-20	75-85	60-75	50-70	15-35	<30	NP-5
	25-60	STX-LFS	GM, GW-GM, SM	A-1	30-60	45-65	20-40	15-35	5-15	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification		Fragments	Percent Passing By Weight				Liquid Limit	Plasticity Index
			Unified	AASHTO	> 3 Inches	4 Sieve	10 Sieve	40 Sieve	200 Sieve		
	In.				Pct.					Pct.	
150											
Taboose	0-5	GRV-FSL	GM	A-2, A-1	10-30	60-80	45-70	40-65	15-40	<30	NP-5
	5-60	STX-FSL	GM, SM, GW-GM	A-1	45-65	45-70	25-55	20-50	10-30	<30	NP-5
151											
Thibau.	0-60	LCOS, GR-LCOS	SM, SW-SM	A-1, A-2	0-20	85-100	55-90	30-70	5-30	-----	NP
152											
Thibau.	0-44	GR-LCOS, LCOS	SW-SM, SM	A-1, A-2	0-20	70-100	55-90	30-70	5-30	-----	NP
	44-60	GRV-LCOS	SW-SM	A-1, A-2	0-20	30-50	20-40	10-20	0-5	-----	NP
153											
Tinemaha.	0-9	BYV-LCOS	SM	A-1, A-2	30-70	80-95	55-90	30-70	10-30	-----	NP
	9-27	STV-SL, STV-SCL	SM-SC, SC	A-2, A-4, A-6	30-80	80-95	55-90	40-80	15-40	20-40	5-15
	27-60	STV-LCOS	SM	A-1, A-2	30-80	80-95	55-90	30-75	10-35	<25	NP-5
154											
Tinemaha.	0-9	BY-LCOS	SM	A-1, A-2	10-40	80-95	55-90	30-75	10-35	<25	NP-5
	9-27	STV-SL, CBV-SL, STV-SCL, CBV-SCL	SM-SC, SC	A-2, A-4, A-6	30-80	80-95	55-90	40-80	15-40	20-40	5-15
	27-60	STV-LCOS	SM	A-1, A-2	30-80	80-95	55-90	30-75	10-35	<25	NP-5
Lubkin.	0-3	LCOS	SM	A-2, A-1	0-20	90-100	70-90	40-75	15-35	<25	NP-5
	3-35	GR-SL	SM-SC	A-2, A-4	0-25	80-95	55-90	40-80	15-40	15-25	5-10
	35-60	GR-LCOS, CB-LCOS	SM	A-1, A-2	5-30	80-95	55-90	30-75	10-35	<25	NP-5
155											
Xeralfic Haplargids, mesic	0-12	ST-LCOS, BYV-LCOS, BYX-LCOS, GRV-SL	SM	A-1, A-2	10-90	80-95	55-85	30-70	10-35	<25	NP-5
	12-31	STV-SL, STV-SCL, BYX-SL, CBV-SCL	SM-SC, SC	A-2, A-4, A-6	30-70	80-95	55-85	40-75	15-40	20-40	5-15
	31-60	CBV-LCOS, STV-LCOS, CBX-LCOS, BYX-LCOS	SM	A-1, A-2	30-85	80-95	55-85	30-65	10-25	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
156											
Lithic Xeric Torriorthents	0-7	CB-SL, GR-SL, CBV-SL, GR-LS	SM, SM-SC	A-2, A-1	5-50	65-90	50-80	40-70	15-35	<30	NP-10
	7	UWB									
Buscones.	0-31	LS, GR-LS	SM, SW-SM	A-2, A-1	0	60-100	55-95	30-75	10-30	-----	NP
	31	WB									
157											
Torriorthents, frigid[1].	0-35	ST-COSL, STV-LCOS, BY-LCOS, BYV-COSL	SM, SW-SM	A-1, A-2	15-70	80-95	50-80	30-65	10-20	-----	NP
	35+	WB									
Haplargids, frigid.[1] . .	0-10	ST-COSL, STV-LCOS, BY-LCOS, BYV-COSL	SM, SW-SM	A-1, A-2	15-70	55-90	50-80	30-65	10-20	-----	NP
	10-20	ST-SCL, BY-SCL, BYV-SCL	SC	A-2, A-6	15-70	55-90	50-80	40-70	15-40	30-40	10-20
	20+	WB									
158											
Torripsamments.	0-2	GR-COS	SW-SM, SM	A-1, A-2	0	75-90	60-75	30-55	5-15	-----	NP
	2-60	LCOS, GR-LCOS	SM	A-1, A-2	0	75-90	60-75	35-60	10-25	-----	NP
Cinder Land	0-60	CIND	GW	A-1	0	25-45	5-10	3-7	0-5	-----	NP
159											
Tuttle.	0-12	BYV-LCOS	SM	A-1, A-2	30-70	80-95	55-85	30-65	10-25	-----	NP
	12-60	STV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-85	30-65	10-25	-----	NP
160											
Tuttle.	1-12	BYV-LCOS	SM	A-1, A-2	30-70	80-95	55-85	30-65	10-25	-----	NP
	12-60	STV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-85	30-65	10-25	-----	NP
161											
Tuttle.	0-12	BY-LCOS	SM	A-1, A-2	5-35	80-95	55-85	30-65	10-25	-----	NP
	12-60	STV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-85	30-65	10-25	-----	NP

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments >3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
161 (cont.)											
Rovana.	0-60	GR-LCOS, LCOS	SM, SW-SM	A-2, A-1	0-25	80-100	50-90	30-70	10-30	-----	NP
162											
Tuttle.	0-12	BY-LCOS	SM	A-1, A-2	5-35	80-95	55-85	30-65	10-25	-----	NP
	12-60	STV-LCOS, STX-LCOS	SM	A-1, A-2	30-80	80-95	55-85	30-65	10-25	-----	NP
Rovana.	0-60	GR-LCOS, LCOS	SM, SW-SM	A-2, A-1	0-25	80-100	50-90	30-70	10-30	-----	NP
163											
Tuttle Variant.	0-8	SL	SM	A-2, A-4	0-25	80-95	75-90	60-80	20-40	<25	NP-5
	8-32	GRV-SL, CBV-SL	SM, SW-SM	A-1, A-2	0-30	50-90	30-70	25-60	10-30	<25	NP-5
	32-60	S, LS, GR-SL	SP-SM, SM	A-2	0-10	100	90-100	70-80	10-20	-----	NP
164											
Victorville family. . .	0-12	L, VFSL, SL, FS	SM, SM-SC, ML	A-4, A-2	0	100	95-100	80-90	40-50	20-35	NP-10
	12-60	SR-FS, LVFS, SL, L, VFSL	SM, SM-SC, ML	A-2, A-4	0	100	95-100	85-95	45-60	<35	NP-10
Villa family.	0-17	S, FS	SM, SP-SM	A-2	0	100	95-100	65-90	10-25	-----	NP
	17-60	SR-SIL, FS, COS	SM, ML, SP-SM	A-2, A-4	0	100	95-100	50-95	10-75	<35	NP-10
165											
Water	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
166											
Whitewolf family[1]. . .	0-2	COS	SW-SM, SM	A-1, A-2	0-10	85-95	60-75	30-60	10-15	-----	NP
	2-43	LCOS	SM	A-2, A-1	0-10	90-100	75-90	40-70	10-30	-----	NP
	43+	WB									
Toquerville family. . .	0-5	GR-LCOS, CB-LCOS, ST-S, BY-S	SM, SW-SM	A-1, A-2	10-30	80-95	60-90	30-70	10-30	-----	NP
	5+	UWB									

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments >3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
167											
Xeric Torriorthents . .	0-44	SL, LS	SM	A-2, A-4	0	95-100	90-100	65-90	15-50	<25	NP-5
	44-60	SR-SCL, SICL	SC, CL	A-6, A-7	0	100	95-100	80-100	35-90	30-50	10-25
168											
Xeric Torriorthents, sodic	0-23	SICL, SIL	CL, ML-CL	A-6, A-4	0	100	100	85-100	70-90	20-50	5-25
	23-32	S	SW-SM, SM	A-3, A-2	0	100	90-100	70-85	5-20	-----	NP
	32-60	SICL, SIL	CL, ML-CL	A-6, A-4	0	100	100	85-100	70-90	20-50	5-25
169											
Xeric Torriorthents, ashy.	0-12	S, COS, GR-COS, FSL	SW-SM, SM	A-2, A-1	0	85-100	75-100	40-85	5-20	-----	NP
	12-60	SR-SIL, COS, FSL, S, GR-S	SM, SW-SM, ML-CL	A-1, A-2, A-4	0	60-100	35-100	15-95	3-80	<40	NP-10
Durorthids, ashy[1] . . .	0-10	GR-S, LS, GR-COS	SW-SM, SM	A-1, A-2	0	80-100	60-100	30-85	5-20	-----	NP
	10-14	IND	-----	-----	-----	-----	-----	-----	-----	-----	-----
	14-60	SR-COS, LS, GR-S	SW-SM, SM, SW	A-1, A-2	0	60-100	30-100	15-85	3-30	-----	NP
170											
Xerollic Durorthids[1]. .	0-24	GR-LS, GR-LCOS	SM, SW-SM	A-2, A-1	0-10	85-100	50-90	30-80	10-30	-----	NP
	24	IND									
171											
Yellowrock.	0-3	S	SM, SW-SM	A-2	0-5	90-100	75-95	50-80	10-20	-----	NP
	3-60	SR-LS, GR-S	SM, SW-SM	A-2	0-5	90-100	70-95	50-80	10-30	-----	NP
172											
Yellowrock.	0-4	LS	SM, SW-SM	A-2, A-1	0-5	85-100	50-90	35-80	10-30	-----	NP
	4-12	SL	SM	A-2	0	90-100	75-90	55-80	20-35	<25	NP-5
	12-60	SR-LS, GR-COS, GR-SL, CBV-LS	SM, SW-SM	A-1	0-40	75-100	50-100	35-85	10-30	<25	NP-5

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
172 (cont.)											
Seaman.	0-3	LS	SM	A-2	0-5	90-100	75-100	55-85	15-30	-----	NP
	3-6	SL	SM, SM-SC	A-2, A-4	0-5	90-100	75-100	50-90	20-45	<30	NP-10
	6-60	SR-SL, LS, SIL	SM, SM-SC, ML-CL	A-2, A-4	0-5	90-100	75-100	50-95	15-75	<40	NP-10
173											
Yermo	0-60	GRX-SL	GM, GW-GM	A-1	15-35	25-55	15-40	10-35	5-20	<30	NP-10
174											
Yermo, extremely gravelly.	0-1	GRX-SL	GM, GW-GM, GM-GC	A-1	5-35	20-65	10-40	7-35	3-20	<30	NP-10
	1-4	GRV-SL	GM, GM-GC	A-1, A-2	5-35	40-80	30-60	20-55	10-30	<30	NP-10
	4-60	GRV-SL, GRX-SL	GM, GW-GM, GM-GC	A-1, A-2	5-35	30-65	20-50	15-45	5-25	<30	NP-10
Yermo, stony.	0-4	ST-SL	GM, GM-GC	A-1, A-2	15-50	40-70	30-60	20-55	10-30	<30	NP-10
	4-60	CBV-SL, GRV-SL	GM, GW-GM, GM-GC	A-1, A-2	25-50	30-60	20-50	15-45	5-25	<30	NP-10
175											
Zono.	0-3	COS	SW-SM, SM	A-1, A-2	0-10	80-100	60-95	30-80	5-20	-----	NP
	3-30	LS, GR-S	SM, SW-SM	A-2	0-10	90-100	70-95	50-80	5-30	-----	NP
	30-34	CBV-S	SM, SW-SM	A-2	0-55	90-100	70-95	50-80	5-30	-----	NP
	34-41	GR-SL	SM, SM-SC	A-2, A-4, A-1	5-20	70-100	55-90	40-80	15-40	15-25	NP-10
	41	WB									
176											
Honova Variant.	0-6	LCOS	SM	A-2	0-5	85-100	75-90	55-75	15-25	-----	NP
	6	WB									

TABLE I -- ENGINEERING INDEX PROPERTIES (Cont.)

Soil Name and Map Symbol	Depth	USDA Texture	Classification: Unified	Classification: AASHTO	Fragments > 3 Inches	Percent Passing By Weight: 4 Sieve	10 Sieve	40 Sieve	200 Sieve	Liquid Limit	Plasticity Index
	In.				Pct.					Pct.	
177											
Yermo, extremely gravelly.	0-1	GRX-SL	GM, GW-GM, GM-GC	A-1	5-35	25-65	10-40	7-35	3-20	<30	NP-10
	1-4	GRV-SL	GM, GM-GC	A-1, A-2	5-35	40-80	30-60	20-55	10-30	<30	NP-10
	4-60	GRV-SL, GRX-SL	GM, GW-GM, GM-GC	A-1, A-2	5-35	30-65	20-50	15-45	5-25	<30	NP-10
Yermo, stony.	0-4	ST-SL	GM, GM-GC	A-1, A-2	15-50	40-70	30-60	20-55	10-30	<30	NP-10
	4-60	CBV-SL, GRV-SL	GM, GW-GM, GM-GC	A-1, A-2	25-50	30-60	20-50	15-45	5-25	<30	NP-10
178											
Entic Durorthids. . . .	0-1	GRV-SL, GRX-SL	GM-GC, GW-GM	A-1	10-30	35-70	15-50	10-45	5-25	20-30	5-10
	1-15	GR-SL	GM-GC, SM-SC	A-2	10-30	50-85	30-75	25-65	15-35	20-30	5-10
	15-40	GRV-SL, IND	GM-GC	A-2, A-1	10-30	50-65	30-50	25-45	15-25	20-30	5-10
	40-60	GRX-SL, GRX-LS	GM-GC, GM	A-2, A-1	10-30	50-65	25-50	20-40	10-25	<25	NP-10
Typic Durorthids. . . .	0-1	GRV-SL, GRX-SL	GM-GC, GW-GM	A-1	10-30	35-70	15-50	10-45	5-25	20-30	5-10
	1-5	GR-SL, SL	SM-SC	A-2, A-4	2-30	65-90	50-85	45-75	20-40	20-30	5-10
	5-17	IND	-----	-----	-----	-----	-----	-----	-----	-----	-----
	20-60	GRV-SL, GRX-SL	GM-GC, GM	A-2, A-1	10-30	50-65	25-50	20-40	10-25	<25	NP-10

[1] Soil depth class is variable. Depths shown refer to the reference pedon only. See mapping unit description for full depth range.

PHYSICAL AND CHEMICAL PROPERTIES

Table J shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the inventory area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25°C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. Salinity affects the suitability of a soil for plant production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are low, a change less than 3 percent; moderate, 3 to 6 percent; and high, more than 6 percent. Very high, greater than 9 percent is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas or areas where the plant cover is disturbed by overgrazing or excessive traffic. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils with less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams with more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils with less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils with 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams with less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
101									
Alamedawell	0-32	6.0-20	.10-.12	7.9-8.4	<2	Low	.24	5	1
	32-60	0.2-0.6	.14-.18	8.5-9.0	<2	Low	.55		
Deepwell.	0-60	6.0-20	.08-.10	6.8-7.5	<2	Low	.17	5	1
102									
Aquents	0-5	0.6-20[1]	.04-.11	7.8-10	2-20	Low	.32	5	8
	5-60	0.2-0.6[1]	.06-.20	7.0-8.4	<2	Low	.20-.64		
Aquic Torriorthents . .	0-12	0.6-20	.03-.16	7.8-10	2-20	Low	.20-.43	5	1-4L
	23-60	0.6-2.0[1]	.05-.10	7.0-9.0	<2	Low	.20-.64		
103									
Aquents	0-5	0.6-20[1]	.04-.11	7.8-10	2-20	Low	.32	5	8
	5-60	0.2-0.6[1]	.06-.20	7.0-8.4	<2	Low	.20-.64		
Aquic Torriorthents . .	0-12	0.6-20	.03-.16	7.8-10	2-20	Low	.20-.43	5	1-4L
	23-60	0.6-2.0[1]	.05-.10	7.0-9.0	<2	Low	.20-.64		
Deepwell.	0-60	6.0-20	.08-.10	6.8-7.5	<2	Low	.20	5	1
104									
Arizo	0-10	6.0-20	.02-.06	7.4-8.0	<2	Low	.10	5	8
	10-60	6.0-20	.02-.05	7.4-8.0	<2	Low	.05		
105									
Arizo	0-10	6.0-20	.03-.06	7.4-8.4	<2	Low	.15	5	2
	10-60	6.0-20	.02-.05	7.4-8.4	<2	Low	.05		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
105 (cont.)									
Yellowrock.	0-10	6.0-20	.03-.06	7.4-8.4	<2	Low	.10	5	2
	10-60	6.0-20	.03-.06	7.4-8.4	<2	Low	.17		
106									
Badland	0-60	0.06-0.2	.13-.18	8.5-10.0	2-4	Low-Mod	.55	5	4L
107									
Washoe.	0-20	6.0-20	.02-.06	6.5-7.3	<2	Low	.10	5	8
	20-44	0.2-6.0	.06-.11	6.5-7.3	<2	Low	.10		
	44-60	6.0-20	.02-.05	6.5-7.3	<2	Low	.05		
108									
Washoe.	0-20	6.0-20	.03-.06	6.5-7.2	<2	Low	.15	5	2
	20-44	0.2-6.0	.06-.11	6.5-7.2	<2	Low	.10		
	44-60	6.0-20	.02-.05	6.5-7.2	<2	Low	.05		
Washoe Variant.	0-12	2.0-20	.03-.09	6.5-7.2	<2	Low	.15	5	2
	12-41	0.2-0.6	.07-.15	6.5-7.2	<2	Low-Mod	.15		
	41-60	2.0-6.0	.02-.07	6.5-7.2	<2	Low	.10		
109									
Berent family[3]	0-60	6.0-20	.04-.07	6.6-7.3	<2	Low	.15	2-5	2
Glenbrook family. . . .	0-11	6.0-20	.03-.07	6.6-7.5	<2	Low	.15	1	2
110									
Bitter.	0-8	6.0-20	.04-.07	7.4-8.4	<2	Low	.15	5	2
	8-30	0.2-6.0	.03-.11	7.4-8.4	<2	Low	.10		
	30-60	2.0-20	.02-.07	7.4-8.4	<2	Low	.10		
Garlock Variant	0-6	2.0-20	.05-.10	7.4-8.4	<2	Low	.17	5	2
	6-27	0.2-0.6	.09-.15	7.4-8.4	<2	Low-Mod	.17		
	27-60	2.0-6.0	.03-.10	7.4-8.4	<2	Low	.15		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
111									
Brantel	0-60	>20	.05-.09	6.1-7.8	<2	Low	.20	5	1
112									
Brantel	0-32	6-20	.10-.12	6.5-7.5	<2	Low	.24	5	2
	32-60	6-20	.08-.12	6.6-7.5	<2	Low	.20		
113									
Brantel Variant	0-9	6->20	.04-.09	6.4-7.0	<2	Low	.15	2-5	2
	9-60	6->20	.01-.04	6.4-7.0	<2	Low	.05		
Brantel	0-60	>20	.05-.09	6.4-7.0	<2	Low	.15	5	2
114									
Buscones.	0-1	6-20	.05-.08	6.6-7.3	<2	Low	.20	2	2
	1-18	6-20	.10-.12	6.6-7.3	<2	Low	.24		
	18-31	6-20	.07-.10	6.6-7.3	<2	Low	.20		
115									
Cajon	0-35	0-35	.03-.07	7.4-8.0	<2	Low	.17	5	2
	35-60	35-60	.03-.06	7.4-8.0	<2	Low	.15		
116									
Cashbaugh	0-10	6-20	.05-.08	6.4-7.0	<2	Low	.24	1	2
Buscones.	0-26	6-20	.05-.08	6.4-7.0	<2	Low	.24	2	2
117									
Cashbaugh	0-17	6-20	.08-.12	6.5-7.0	<2	Low	.24	1	2
Brantel	0-60	6-20	.08-.12	6.5-7.0	<2	Low	.24	5	2
118									
Chidago	0-36	6-20	.10-.12	6.8-7.8	<2	Low	.24	2	2

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
119 Cowtrack.	0-34	6.0-20	.10-.12	6.1-7.0	<2	Low	.20	3	1
	34-44	0.6-6.0	.09-.15	6.6-7.0	<2	Low	.24		
	44-50	0.2-0.6	.12-.19	6.6-7.0	<2	Low-Mod	.24		
120 Cowtrack Variant. . . .	0-13	6.0-20	.08-.11	6.4-7.3	<2	Low	.20	5	2
	13-60	6.0-20	.05-.09	6.4-7.3	<2	Low	.20		
121 Cryoborolls[3].	0-11	2.0-6.0	.05-.10	6.6-7.3	<2	Low	.15	1-3	8[2]
	11-20	0.2-6.0	.04-.14	6.6-7.3	<2	Low	.17		
122 Cryoborolls[3].	0-11	2.0-20	.03-.10	6.4-7.0	<2	Low	.10	1-3	8
	11-17	0.2-20	.03-.15	6.4-7.0	<2	Low-Mod	.10		
123 Durargids, shallow. . .	0-2	6.0-20	.04-.06	6.5-7.3	<2	Low	.15	1	3
	2-5	2.0-6.0	.06-.12	6.5-7.3	<2	Low	.17		
	5-19	<0.06-0.6	.13-.17	6.5-7.3	<2	Mod-High	.24		
	19-54	<0.06	---	---	---	---	---		
	54-60	>20	.04-.07	6.5-7.3	<2	Low	.20		
124 Entic Durorthids. . . .	0-15	2.0-6.0	.03-.10	7.9-8.4	<2	Low	.15	1, 2	8[2]
	15-40	0.6-2.0	.03-.07	7.9-8.4	<2	Low	.10		
	40-60	2.0-20	.02-.07	7.9-8.4	<2	Low	.10		
Typic Durorthids. . . .	0-5	2.0-6.0	.04-.12	7.9-8.4	<2	Low	.20	1	8[2]
	5-17	<0.06	---	---	---	---	---		
	17-60	2.0-20	.02-.07	7.9-8.4	<2	Low	.10		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
125									
Pajuela	0-12	6.0-20	.02-.06	6.8-7.6	<2	Low	.10	5	8
	12-60	6.0-20	.02-.05	6.8-7.6	<2	Low	.05		
126									
Pajuela	0-12	6.0-20	.03-.06	6.8-7.5	<2	Low	.15	5	2
	12-60	6.0-20	.02-.05	6.8-7.5	<2	Low	.05		
Thibau.	0-60	6.0-20	.04-.07	6.8-7.5	<2	Low	.15	5	2
127									
Halloran Variant. . . .	0-8	0.6-2.0	.06-.10	9.0-10.5	2-4	Low	.28	3	3
	8-23	0.6-2.0	.07-.12	9.0-10.5	4-8	Low	.28		
	23-41	6.0-20	.04-.08	9.0-10.5	4-8	Low	.17		
128									
Hammil.	0-60	6.0-20	.0-.12	6.8-7.5	<2	Low	.24	5	2
129									
Haplargids, frigid[3] . .	0-2	2.0-6.0	.07-.14	6.8-8.0	<2	Low	.20	1-3	8[2]
	2-13	0.2-2.0	.05-.14	6.8-8.0	<2	Low	.15		
Torriorthents, frigid[3].	0-5	2.0-6.0	.07-.10	6.8-8.0	<2	Low	.20	1-3	8[2]
	5-45	2.0-6.0	.04-.09	6.8-8.0	<2	Low	.15		
130									
Honova.	0-3	6.0-20	.04-.07	6.5-7.5	<2	Low	.15	1	2
	3-7	2.0-6.0	.10-.16	6.5-7.5	<2	Low	.20		
131									
Honova Variant.	0-6	6.0-20	.05-.07	7.4-8.4	<2	Low	.20	1	2

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
132									
Hoye Variant.	0-7	0.6-2.0	.10-.17	7.5-8.4	2-4	Low	.43	5	4L
	7-21	0.2-0.6	.15-.20	7.5-8.4	<2	Mod	.43		
	21-31	.06-0.2	.13-.15	7.5-8.4	<2	High	.32		
	31-60	0.6-2.0	.14-.17	7.5-8.4	<2	Low	.55		
133									
Wellington.	0-5	6.0-20	.05-.08	6.6-7.4	<2	Low	.17	1	2
	5-13	0.2-2.0	.12-.16	6.6-7.4	<2	Mod	.28		
134									
Wellington.	0-7	6.0-20	.04-.07	6.6-7.4	<2	Low	.15	1	2
	7-15	0.2-2.0	.10-.16	6.6-7.4	<2	Mod	.24		
135									
Lithic Torriorthents. .	0-3	0.6-6.0	.04-.14	7.9-8.4	<2	Low	.20	1	8[2]
	3-5	0.6-6.0	.04-.11	7.9-8.4	<2	Low	.15		
Lithic Haplargids . . .	0-4	0.6-2.0	.06-.14	7.9-8.4	<2	Low	.24	1	8[2]
	4-11	0.2-0.6	.11-.16	7.9-8.4	<2	Low-Mod	.20		
136									
Lithic Xerollic Haplargids.	0-3	0.2-6.0	.06-.11	7.4-8.4	<2	Low	.17	1	8[2]
	3-12	0.2-0.6	.06-.16	7.4-8.4	<2	Low-Mod	.15		
Lithic Xeric Torriorthents	0-3	0.6-6.0	.05-.14	7.4-8.4	<2	Low	.17	1	8[2]
	3-12	0.6-6.0	.04-.11	7.4-8.4	<2	Low	.15		
137									
Haar family	0-2	6.0-20.0	.04-.06	6.5-7.3	<2	Low	.17	1	2
	2-5	2.0-6.0	.07-.11	6.5-7.3	<2	Low	.28		
138									
Xeric Torriorthents,[3] very bouldery	0-4	2.0-20.0	.03-.10	6.4-7.0	<2	Low	.15	1,2	8
	4-9	2.0-6.0	.05-.10	6.4-7.0	<2	Low	.15		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors		Wind Erodibility Group
							K	T	
	In.	In/hr	In/in	pH	Mmhos/cm				
139									
Millner	0-8	2.0-6.0	.04-.09	7.4-8.0	<2	Low	.17	5	8[2]
	8-33	2.0-6.0	.07-.11	7.4-8.0	<2	Low	.15		
	33-60	2.0-6.0	.05-.10	7.4-8.0	<2	Low	.17		
Millner, Stony.	0-8	2.0-6.0	.04-.09	7.4-8.0	<2	Low	.17	5	8[2]
	8-60	2.0-6.0	.05-.09	7.4-8.0	<2	Low	.15		
140									
Dotard.	0-3	2.0-6.0	.04-.09	7.4-8.4	<2	Low	.24	5	8[2]
	3-60	2.0-6.0	.05-.10	7.4-8.4	<2	Low	.15		
141									
Pizona.	0-11	6.0-20	.05-.10	6.6-7.3	<2	Low	.15	3	2
	11-17	2.0-6.0	.05-.10	7.0-7.8	<2	Low	.15		
	17-44	0.2-6.0	.07-.11	7.0-7.8	<2	Low	.10		
Brantel	0-60	6.0-20	.08-.12	6.6-7.8	<2	Low	.20	5	1
142									
Avalmount	0-10	2.0-6.0	.07-.10	6.6-7.3	<2	Low	.15	5	8[2]
	10-30	0.6-2.0	.06-.09	6.6-7.3	<2	Low	.15		
	30-60	0.6-2.0	.03-.09	6.6-7.3	<2	Low	.15		
143									
Playa	0-60	0.2-20[1]	0-.03	8.5-11	>16[1]	Low	.20-.49	5	1-4L
144									
Rock Outcrop.	------	---------------	------------	-----------	-----------	---------------	--------	--------	-------
145									
Rovana.	0-60	6.0-20	.04-.07	6.5-7.3	<2	Low	.15	5	2

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
146 Rovana.	0-10	6.0-20	.06-.09	6.5-7.3	<2	Low	.20	5	2
	10-60	6.0-20	.05-.08	6.5-7.3	<2	Low	.17		
147 Sawavu.	0-24	6.0-20	.10-.12	6.5-7.8	<2	Low	.20	5	1
	24-50	6.0-20	.05-.10	6.5-7.8	<2	Low	.17		
	50-60	6.0-20	.07-.11	6.6-7.8	<2	Low	.17		
Brantel	0-32	6.0-20	.10-.12	6.5-7.5	<2	Low	.24	5	1
	32-60	6.0-20	.08-.12	6.6-7.5	<2	Low	.20		
148 Sherwin	0-3	6.0-20	.04-.06	6.6-7.3	<2	Low	.10	1	2
	3-7	2.0-6.0	.08-.12	6.6-7.3	<2	Low	.28		
149 Taboose	0-5	6.0-20	.07-.10	6.8-7.5	<2	Low	.10	5	8[2]
	5-25	2.0-6.0	.08-.11	6.8-7.5	<2	Low	.15		
	25-60	2.0-20	.03-.09	6.8-7.5	<2	Low	.10		
150 Taboose	0-5	2.0-6.0	.07-.10	7.9-8.4	<2	Low	.15	5	8[2]
	5-60	2.0-6.0	.03-.09	7.9-8.4	<2	Low	.10		
151 Thibau.	0-60	6.0-20	.04-.07	6.8-7.5	<2	Low	.15	5	2
152 Thibau.	0-60	6.0-20	.04-.06	6.8-7.5	<2	Low	.15	5	2

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
153									
Tinemaha.	0-9	6.0-20	.03-.05	6.5-7.3	<2	Low	.10	5	8
	9-27	0.2-6.0	.04-.11	6.5-7.3	<2	Low	.10		
	27-60	2.0-20	.02-.06	6.5-7.3	<2	Low	.10		
154									
Tinemaha.	0-9	6.0-20	.04-.07	6.5-7.3	<2	Low	.15	5	2
	9-27	0.2-6.0	.04-.11	6.5-7.3	<2	Low	.10		
	27-60	2.0-20	.02-.06	6.5-7.3	<2	Low	.10		
Lubkin.	0-3	2.0-20	.04-.07	6.5-7.3	<2	Low	.17	5	2
	3-35	2.0-6.0	.07-.11	6.5-7.3	<2	Low	.15		
	35-60	2.0-20	.04-.09	6.5-7.3	<2	Low	.15		
155									
Xeralfic Haplargids, mesic	0-12	2.0-20	.01-.08	6.8-7.5	<2	Low	.10	5	8
	12-31	0.2-6.0	.04-.11	6.8-7.5	<2	Low	.10		
	31-60	6.0-20	.02-.05	6.8-7.5	<2	Low	.10		
156									
Lithic Xeric Torriorthents	0-7	2.0-6.0	.05-.10	6.8-7.5	<2	Low	.15	1	8[2]
Buscones.	0-31	6.0-20	.07-.11	6.6-7.3	<2	Low	.17	2	2
157									
Torriorthents, frigid[3] .	0-35	6.0-20	.03-.06	6.6-7.3	<2	Low	.10	1-3	8
Haplargids, frigid[3] . .	0-10	6.0-20	.02-.05	6.6-7.3	<2	Low	.10	1-3	8
	10-20	0.2-2.0	.05-.12	6.6-7.3	<2	Low-Mod	.10		
158									
Torripsamments.	0-60	6.0-20	.04-.07	6.6-7.3	<2	Low	.17	5	2
Cinder land	0-60	>20	0-.01	-----------	-----------	Low	--------	--------	8

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors		Wind Erodibility Group
							K	T	
	In.	In/hr	In/in	pH	Mmhos/cm				
159									
Tuttle.	0-12	6.0-20	.03-.07	6.5-7.3	<2	Low	.15	5	8
	12-60	6.0-20	.02-.05	6.5-7.3	<2	Low	.10		
160									
Tuttle.	0-12	6.0-20	.03-.07	6.5-7.3	<2	Low	.15	5	8
	12-60	6.0-20	.02-.05	6.5-7.3	<2	Low	.10		
161									
Tuttle.	0-12	6.0-20	.04-.07	6.5-7.3	<2	Low	.15	5	2
	12-60	6.0-20	.02-.05	6.5-7.3	<2	Low	.10		
Rovana.	0-60	6.0-20	.04-.07	6.5-7.3	<2	Low	.17	5	2
162									
Tuttle.	0-12	6.0-20	.04-.07	6.5-7.3	<2	Low	.15	5	2
	12-60	6.0-20	.02-.05	6.5-7.3	<2	Low	.10		
Rovana.	0-60	6.0-20	.04-.07	6.5-7.3	<2	Low	.17	5	2
163									
Tuttle Variant.	0-8	2.0-6.0	.09-.11	6.4-7.0	<2	Low	.20	5	3
	8-32	2.0-6.0	.04-.07	6.4-7.0	<2	Low	.10		
	32-60	2.0-20	.04-.08	6.4-7.0	<2	Low	.15		
164									
Victorville family. . .	0-12	0.6-2.0	.01-.10	>9.0	2-16	Low	.55	5	1-4L
	12-60	0.6-2.0	.06-.11	>8.5	2-16	Low	.43		
Villa family.	1-17	6.0-20	.05-.08	>9.0	2-8	Low	.20	5	1
	17-60	0.6-20	.05-.10	>8.5	2-8	Low	.20		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
166									
Whitewolf family[3] . . .	0-43	6.0-20	.05-.07	6.8-7.7	<2	Low	.20	2-5	2
Toquerville family. . .	0-5	6.0-20	.04-.07	6.8-7.7	<2	Low	.15	1	8
167									
Xeric Torriorthents . .	0-44	2.0-20	.06-.12	6.0-7.7	<2	Low	.24	5	3
	44-60	0.06-0.6	.13-.20	6.8-8.0	<2	Mod	.43		
168									
Xeric Torriorthents,	0-23	<0.06-0.2	.10-.15	8.5-11.0	1-15	Low-Mod	.43	5	4L
sodic	23-32	6.0-20	.07-.09	7.8-8.4	<2	Low	.20		
	32-60	<0.06-0.2	.10-.15	9.0-11.0	2-10	Low-Mod	.43		
169									
Xeric Torriorthents,	0-12	2.0-20	.05-.12	7.4-8.1	<2	Low	.17	5	1
ashy.	12-60	0.6-6.0	.09-.12	7.4-8.5	<2	Low	.15		
Durorthids, ashy[3] . . .	0-10	6.0-20	.05-.10	7.4-8.0	<2	Low	.17	1,2	1
	10-14	---------------	------------	-----------	-----------	---------------	--------		
	14-60	6.0-20	.05-.10	7.4-8.0	<2	Low	.15		
170									
Xerollic Durorthids[3]. .	0-24	6.0-20	.03-.10	6.8-7.5	<2	Low	.17	1,2	2
171									
Yellowrock.	0-3	6.0-20	.04-.06	9.0-10.5	1-4	Low	.17	5	1
	3-60	6.0-20	.04-.06	9.0-10.5	4-12	Low	.17		
172									
Yellowrock.	0-4	6.0-20	.06-.08	7.9-8.5	<2	Low	.15	5	2
	4-12	2.0-6.0	.10-.11	7.9-9.5	<2	Low	.24		
	12-60	2.0-6.0	.04-.08	8.5-9.5	<2	Low	.15		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
172 (cont.)									
Seaman.	0-3	6.0-20	.06-.08	7.9-8.5	<2	Low	.20	5	2
	3-6	2.0-6.0	.10-.11	7.9-8.5	<2	Low	.28		
	6-60	2.0-6.0	.10-.12	7.9-9.5	<2	Low	.28		
173									
Yermo	0-5	2.0-6.0	.03-.07	9.0-9.5	1-4	Low	.10	5	8[2]
	5-60	2.0-6.0	.01-.05	9.0-10.5	8-30	Low	.10		
174									
Yermo, extremely gravelly.	0-4	2.0-6.0	.03-.07	7.8-8.4	<2	Low	.15	5	8[2]
	4-35	2.0-6.0	.04-.08	7.8-8.4	<2	Low	.10		
	35-60	2.0-6.0	.02-.08	7.8-9.0	2-8	Low	.10		
Yermo, stony.	0-4	2.0-6.0	.03-.07	7.8-8.4	<2	Low	.10	5	8[2]
	4-35	2.0-6.0	.02-.07	7.8-8.4	<2	Low	.10		
	35-60	2.0-6.0	.02-.07	7.8-9.0	2-8	Low	.10		
175									
Zono.	0-3	6.0-20	.06-.10	6.4-7.0	<2	Low	.15	3	1
	3-30	6.0-20	.06-.11	6.4-7.0	<2	Low	.17		
	30-34	6.0-20	.06-.11	6.4-7.0	<2	Low	.15		
	34-41	2.0-6.0	.06-.11	6.6-7.3	<2	Low	.17		
176									
Honova Variant.	0-6	6.0-20	.05-.07	7.4-8.4	<2	Low	.20	1	2
177									
Yermo, extremely gravelly.	0-4	2.0-6.0	.03-.07	7.8-8.4	<2	Low	.15	5	8[2]
	4-35	2.0-6.0	.04-.08	7.8-8.4	<2	Low	.10		
	35-60	2.0-6.0	.02-.08	7.8-9.0	2-8	Low	.10		

TABLE J -- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

Soil Name and Map Symbol	Depth	Permeability	Available Water Capacity	Soil Reaction	Salinity	Shrink-swell Potential	Erosion Factors K	Erosion Factors T	Wind Erodibility Group
	In.	In/hr	In/in	pH	Mmhos/cm				
177 (cont.)									
Yermo, stony.	0-4	2.0-6.0	.03-.07	7.8-8.4	<2	Low	.10	5	8[2]
	4-35	2.0-6.0	.02-.07	7.8-8.4	<2	Low	.10		
	35-60	2.0-6.0	.02-.07	7.8-9.0	2-8	Low	.10		
178									
Entic Durorthids. . . .	0-15	2.0-6.0	.03-.10	7.9-8.4	<2	Low	.15	1, 2	8[2]
	15-40	0.6-2.0	.03-.07	7.9-8.4	<2	Low	.10		
	40-60	2.0-20	.02-.07	7.9-8.4	<2	Low	.10		
Typic Durorthids. . . .	0-5	2.0-6.0	.04-.12	7.9-8.4	<2	Low	.20	1	8[2]
	5-17	<0.06	------------	-----------	-----------	---------------	--------		
	17-60	2.0-20	.02-.07	7.9-8.4	<2	Low	.10		

1 Above the water table.
2 Soil is very dusty if disturbed when dry. Some wind erosion may occur if surface pavement is displaced.
3 Soil depth class is variable. Depths shown refer to the reference pedon only. See mapping unit description for full depth range.

SOIL AND WATER FEATURES

Table K gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receiving precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a clay pan or clay layer at or near the surface and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations made during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation are also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the

sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as <u>low</u>, <u>moderate</u>, or <u>high</u>, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as <u>low</u>, <u>moderate</u>, or <u>high</u>. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

TABLE K -- SOIL AND WATER FEATURES

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
101							
Alamedawell	A	>60	--------	---	--------	High	Low
Deepwell.	A	>60	--------	---	--------	Moderate	Low
102							
Aquents	D	>60	--------	---	--------	High	Low-Moderate
Aquic Torriorthents . .	C	>60	--------	---	--------	High	Moderate-High
103							
Aquents	D	>60	--------	---	--------	High	Low-Moderate
Aquic Torriorthents . .	C	>60	--------	---	--------	High	Moderate-High
Deepwell.	A	>60	--------	---	--------	Moderate	Low
104							
Arizo	A	>60	--------	---	--------	High	Low
105							
Arizo	A	>60	--------	---	--------	High	Low
Yellowrock.	A	>60	--------	---	--------	High	Low
106							
Badland	D	>60	--------	---	--------	High	Low
107							
Washoe.	B	>60	--------	---	--------	Low-Moderate	Low
108							
Washoe.	B	>60	--------	---	--------	Low-Moderate	Low
Washoe Variant.	B	>60	--------	---	--------	Low-Moderate	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
109							
Berent family	A	20->60	Rippable	---	--------	Low	Low
Glenbrook family. . . .	C	10-20	Rippable	---	--------	Low	Low
110							
Bitter.	B	>60	--------	---	--------	High	Low
Garlock Variant	B	>60	--------	---	--------	High	Low
111							
Brantel	A	>60	--------	---	--------	Low-Moderate	Low
112							
Brantel	A	>60	--------	---	--------	Low-Moderate	Low
113							
Brantel Variant	A	>60	--------	---	--------	Low	Low
Brantel	A	>60	--------	---	--------	Low-Moderate	Low
114							
Buscones.	A	20-40	Rippable	---	--------	Low	Low
115							
Cajon	A	>60	--------	---	--------	High	Low
116							
Cashbaugh	D	6-20	Hard	---	--------	Low	Low
Buscones.	C	20-40	Hard	---	--------	Low	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
117							
Cashbaugh	D	6-20	Hard	---	--------	Low	Low
Brantel	A	>60	--------	---	--------	Low-Moderate	Low
118							
Chidago	A	20-40	Rippable	---	--------	Moderate	Low
119							
Cowtrack.	A	40-60	Hard	---	--------	Low-Moderate	Low
120							
Cowtrack Variant. . . .	A	>60	--------	---	--------	Low	Low
121							
Cryoborolls	B, C, D	10-60	Hard	---	--------	Moderate	Low
122							
Cryoborolls	B, C	10-60	Rippable	---	--------	Low	Low
123							
Durargids, shallow. . .	D	>60	--------	10-20	Hard	Moderate	Low
124							
Entic Durorthids. . . .	C	>60	--------	10-40	Rippable	High	Low
Typic Durorthids. . . .	D	>60	--------	4-20	Hard	High	Low
125							
Pajuela	A	>60	--------	-----	--------	Moderate	Low
126							
Pajuela	A	>60	--------	-----	--------	Moderate	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth In.	Hardness	Depth In.	Hardness	Uncoated Steel	Concrete
126 (cont.) Thibau.	A	>60	--------	-----	--------	Moderate	Low
127 Halloran Variant. . . .	B	>60	--------	40-60	Hard	High	Low
128 Hammil.	A	>60	--------	-----	--------	Low-Moderate	Low
129 Haplargids, frigid. . .	B, C, D	10-60	Hard	-----	--------	Moderate	Low
Torriorthents, frigid .	B, C, D	10-60	Hard	-----	--------	Moderate	Low
130 Honova.	D	4-14	Hard	-----	--------	Moderate	Low
131 Honova Variant.	C	5-20	Rippable	-----	--------	High	Low
132 Hoye Variant.	C	>60	--------	-----	--------	High	Low
133 Wellington.	D	>60	--------	10-20	Hard	Moderate	Low
134 Wellington.	D	>60	--------	10-20	Hard	Moderate	Low
135 Lithic Torriorthents. .	D	3-20	Hard	-----	--------	High	Low
Lithic Haplargids . . .	D	7-20	Hard	-----	--------	High	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
136 Lithic Xerollic Haplargids.	D	7-20	Hard	-----	---------	High	Low
Lithic Xeric Torriorthents	D	3-20	Hard	-----	---------	High	Low
137 Haar family	C	4-20	Rippable	-----	---------	Moderate	Low
138 Xeric Torriorthents, very bouldery	B, C	4-40	Rippable	-----	---------	Moderate	Low
139 Millner	B	>60	---------	-----	---------	Moderate	Low
Millner, stony.	B	>60	---------	-----	---------	Moderate	Low
140 Dotard.	B	>60	---------	-----	---------	Moderate	Low
141 Pizona.	B	40-60	Hard	-----	---------	Moderate	Low
Brantel	A	>60	---------	-----	---------	Low-Moderate	Low
142 Avalmount	B	>60	---------	-----	---------	Moderate	Low
143 Playa	C	>60	---------	-----	---------	High	High
144 Rock Outcrop.	D	0	Hard	-----	---------	--------	--------

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth In.	Hardness	Depth In.	Hardness	Uncoated Steel	Concrete
145							
Rovana.	A	>60	--------	-----	--------	Low	Low
146							
Rovana.	A	>60	--------	-----	--------	Moderate	Low
147							
Sawavu.	A	>60	--------	20-40	Rippable	Moderate	Low
Brantel	A	>60	--------	-----	--------	Low-Moderate	Low
148							
Sherwin	D	4-14	Hard	-----	--------	Moderate	Low
149							
Taboose	B	>60	--------	-----	--------	Moderate	Low
150							
Taboose.	B	>60	--------	-----	--------	High	Low
151							
Thibau.	A	>60	--------	-----	--------	Moderate	Low
152							
Thibau.	A	>60	--------	-----	--------	Moderate	Low
153							
Tinemaha.	B	>60	--------	-----	--------	Moderate	Low
154							
Tinemaha.	B	>60	--------	-----	--------	Moderate	Low
Lubkin.	B	>60	--------	-----	--------	Moderate	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
155							
Xeralfic Haplargids, mesic	B	>60	--------	-----	--------	Low-Moderate	Low
156							
Lithic Xeric Torriorthents	D	3-60	Hard	-----	--------	Moderate	Low
Buscones.	A	20-40	Rippable	-----	--------	Low	Low
157							
Torriorthents, frigid .	B, C	10-60	Rippable	-----	--------	Low	Low
Haplargids, frigid. . .	B, C	10-60	Rippable	-----	--------	Low	Low
158							
Torripsamments.	A	>60	--------	-----	--------	Low-Moderate	Low
Cinderland.	A	>60	--------	-----	--------	Low	Low
159							
Tuttle.	A	>60	--------	-----	--------	Moderate	Low
160							
Tuttle.	A	>60	--------	-----	--------	Low-Moderate	Low
161							
Tuttle.	A	>60	--------	-----	--------	Low-Moderate	Low
Rovana.	A	>60	--------	-----	--------	Low-Moderate	Low
162							
Tuttle.	A	>60	--------	-----	--------	Low-Moderate	Low
Rovana.	A	>60	--------	-----	--------	Low-Moderate	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
163 Tuttle Variant.	B	>60	--------	-----	--------	Low	Low
164 Victorville family. . .	C	>60	--------	-----	--------	High	Moderate
Villa family.	B	>60	--------	-----	--------	High	Moderate
165 Water	-----	-----	--------	-----	--------	--------	--------
166 Whitewolf family. . . .	A, B	20->60	Rippable	-----	--------	Moderate	Low
Toquerville family. . .	D	3-20	Hard	-----	--------	Moderate	Low
167 Xeric Torriorthents . .	B, C	>60	Rippable	-----	--------	Moderate-High	Low
168 Xeric Torriorthents, sodic	C, D	>60	--------	-----	--------	High	Low
169 Xeric Torriorthents, ashy.	A	>60	--------	-----	--------	High	Low
Durorthids, ashy. . . .	B, C, D	>60	--------	1-40	Rippable	High	Low
170 Xerollic Durorthids . .	B, C, D	>60	--------	10-40	Hard or Rippable	Moderate	Low

TABLE K -- SOIL AND WATER FEATURES (Cont.)

Soil Name and Map Symbol	Hydrologic Group	Bedrock		Cemented Pan		Risk of Corrosion	
		Depth	Hardness	Depth	Hardness	Uncoated Steel	Concrete
		In.		In.			
171							
Yellowrock.	A	>60	--------	-----	--------	High	High
172							
Yellowrock.	B	>60	--------	-----	--------	High	Low-Moderate
Seaman.	B	>60	--------	-----	--------	High	Low-Moderate
173							
Yermo	B	>60	--------	-----	--------	High	High
174							
Yermo, extremely gravelly.	B	>60	--------	-----	--------	High	Low
Yermo, stony.	B	>60	--------	-----	--------	High	Low
175							
Zono.	A	40-60	Hard or Rippable	-----	--------	Low	Low
176							
Honova Variant.	C	5-20	Rippable	-----	--------	High	Low
177							
Yermo, extremely gravelly.	B	>60	--------	-----	--------	High	Low
Yermo, stony.	B	>60	--------	-----	--------	High	Low
178							
Entic Durorthids. . . .	C	>60	--------	10-40	Rippable	High	Low
Typic Durorthids. . . .	D	>60	--------	4-20	Hard	High	Low

HOW THIS INVENTORY WAS MADE

Soil scientists made this inventory to learn what kinds of soil are in the area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed many facts about the soils, as well as the kinds of native plants, the kinds of rock, and the topography. They dug many soil inspection holes (approx. 1,000) to expose the soil profiles. These holes were not placed at random, but were sited in spots that the soil scientists determined were representative for the local landforms and vegetative communities. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots. The soil scientists drew soil boundaries on aerial photographs, basing the boundaries on the holes dug, landform-soil relationships, and aerial photo interpretation. These photographs show geologic conditions, drainage patterns, vegetation patterns, and other details that help in drawing boundaries accurately. The soil maps in the back of this publication were prepared from the aerial photographs. The areas shown on a soil map are called mapping units. Some mapping units are made up of two or three soils, and some have little or no soil. All mapping units are described in the section "Soil Mapping Unit Descriptions". It is not practical to show on the maps all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a named soil. These "inclusions" are described in the mapping unit descriptions.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in nearby counties and states. They classified and named the soils according to nationwide, uniform procedures of the National Cooperative Soil Survey.

While a soil inventory is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Existing ratings of suitabilities and limitations (interpretations) of the soils are field tested and modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses under different levels of management. For example, data on rangeland productivity are assembled from vegetation survey records made by BLM range conservationists.

But only part of a soil inventory is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so to be readily useful to different groups of users, among them managers of rangeland and woodland, engineers, planners, developers and builders, farmers, and those seeking recreation. Presenting the detailed information in an organized, understandable manner is the purpose of this publication.

HOW THIS INVENTORY WAS MADE

CLIMATE

CLIMATE

The climate of the inventory area reflects a transition between climates of the Mojave Desert, Great Basin, and Sierra Nevada. The Mediterranean climate of the Pacific Coast (wet, cool winters and hot, dry summers) has the strongest influence on the climate of the area. Weather records[3,4] were used to compile the following data.

Precipitation

Storms usually approach from the northwest, coming in from the Pacific Ocean during the period of late October through April. Annual precipitation ranges from a low of 3 to 4 inches at Keeler (northeast edge of Owens Lake) to about 14 inches in the mountains southeast of Mono Lake. In most years, 80 to 95 percent of the precipitation falls during this period. The Sierra Nevada greatly reduces the moisture content of the storms and creates a strong "rain shadow" effect east of its crest. Scattered summer thunderstorms account for the remaining 5 to 20 percent of the annual precipitation. These thunderstorms are usually short but intense. A very rare flash-flooding hazard exists on the alluvial fans at the base of the White-Inyo Mountains and the Sierra Nevada due to this potential thunderstorm activity. Above 6,000 feet most of the precipitation falls as snow. Most of the Benton Unit (west of the town of Benton) gets snowed-in every winter, as evidenced by the fact that Highway 120 from Pumice Valley through Adobe Valley is closed due to snow throughout most of the winter. The Long Valley area also receives much snowfall. Winter storms coming through the Mammoth Gap account for the relatively high snowfall in this area. Over 50 inches of accumulative yearly snowfall is common in this area. Snowmelt at lower elevations, such as Benton, is fairly rapid (snow rarely stays on the ground for more than a week). At elevations above 8,000 feet snowmelt is considerably slower, depending on the weather. The ski resorts in the area may receive three feet of snow in an early winter storm only to be followed by a period of clear, dry weather and barren slopes three weeks later. As a general rule, precipitation increases with an increase in elevation. The Cowtrack Mountain area, Benton Range, and Inyo Mountains receive more precipitation than adjacent valleys. There is also a precipitation gradient from east to west in the inventory area, with more precipitation occurring nearer the Sierra Nevada for a given elevation. See Table L, Figure 3, and Figure 6.

Temperature

The mean annual temperature in the inventory area ranges from a low of about 32°F at the crest of the Inyo Mountains (11,100 ft) to a high of about 60°F on the southern Owens Valley floor (3,600 ft), only 6 miles away. Winters are usually cool to cold with January being the coldest month. Cold air inversions sometimes occur on the floor of Owens Valley. Summers are usually hot in Owens Valley and warm in most of the Benton Unit. July is the hottest month. Summer temperatures of over 100°F are common on the floor of Owens Valley. The high mountain ranges that border the inventory area may be responsible for the relatively high mean annual temperatures in the survey area. Air circulation is inhibited in summer and fall by these mountain ranges, which raises the mean summer and fall temperatures. The Sierra Nevada reduces the moisture content of Pacific storms and may entirely confine some of the weaker storms to the west side of the crest, which further increases the

mean annual temperature. Areas of similar elevation on the west side of the crest may be under a cloud cover while most of the inventory area is sunny. Therefore, the drier air of the area warms more per unit of sun energy than the moister air of the coastal areas, and the adiabatic heating of air descending the east slope of the Sierra Nevada is greater. Also, the west face of the White-Inyo Mountains gives a large surface area for solar heating of the air mass. See Table M and Figure 4.

Frost

The 32°F frost-free season ranges from about 10 days at the crest of the Inyo Mountains to about 230 days on the southern Owens Valley floor. At Bishop the frost-free season usually runs from early May to sometime in October; at Mono Lake it runs from late May through September. See Table . The Mono Lake, Adobe Valley, and Long Valley areas usually have a growing season of 140 to 160 days, which limits the suitable crops for these areas. Even if irrigation water and sufficient acreage were to become available, suitable crops would be limited to carrots, potatoes, beets, onions, beans, cabbage, broccoli, cauliflower, sweet corn, cucumbers, and some varieties of tomatoes. Red delicious apples and certain winter-hardy varieties of alfalfa could be grown, but these would probably not be economically profitable. Sprinkler-irrigated pasture would be an alternative. See Table N and Figure 5.

Wind

The prevailing winds are from the north or south with mean speeds of 5 to 10 mph. March, April, and May are the windiest months. Strong gusts sometimes occur during this period. Summer thunderstorms sometimes create strong localized gusts of wind. See Table O.

Air Quality

Excellent air quality is typical of the area. Visibility exceeds 70 miles at least 85 percent of the time. Particulate matter content is usually minimal. However, strong dust storms occur around dry Owens Lake several times each year. The dust (mainly sodium carbonates, sulfates, and chlorides) originates from the dry lakebed and severely reduces air quality in the southern Owens Valley during these periods. The dust often reaches as far south as Ridgecrest and Searles Lake. Similar air quality conditions are developing around Mono Lake as it recedes.

Table L

PRECIPITATION DATA

Station	Elevation (feet)	Mean Annual Precipitation (inches)	Seasonal Total Snowfall (inches)	Estimated % of Precip. as Snowfall[1]
Benton	5,460	8.7	30*	35
Bishop	4,100	5.7	8.5	15
Bishop Creek	8,150	14.8	125	77
Bishop Union Carbide	9,390	16.0*	150*	80
Ellery Lake	9,600	31.0	250	72
Gem Lake	9,120	25.0	230	77
Haiwee Res.	3,825	6.5	6	9
Independence	3,950	5.2	5*	10
Keeler	3,620	3.1	0	0
Lake Sabrina	9,100	15.3	130	74
Lone Pine	3,730	5.6	5*	9
Lundy Lake	7,760	15.0	113	73
Mono Lake	6,450	12.7	65*	60
South Lake	9,620	16.8*	160	80
White Mtn. #1	10,150	14.5	150*	95
White Mtn. #2	12,470	19.5	220*	95

*Estimated

[1] Assume that 8 to 12 inches of snow yields 1 inch of water, depending on station elevation.

Table M

AIR TEMPERATURE DATA

Station	Elevation (feet)	Mean Annual Temp. °F	Mean Jan. Temp. °F	Mean July Temp. °F	Ave. Highest Summer Temp. °F	Ave. Lowest Winter Temp. °F	Yearly Potential Evapotranspiration (inches)
Benton	5,460	50.0*	34	72	100*	3*	26.6*
Bishop	4,100	55.4	37	76	105*	5*	29.3*
Bishop Creek	8,150	43.0*	29*	61*	87	2	21.0*
Bishop Union Carbide	9,390	38*	26*	55	84	0*	19.0*
Bodie	8,370	37.0	24*	55*	85	-21	20*
Ellery Lake	9,600	39	23	55	80*	-10*	17*
Gem Lake	9,120	43	26	60	82*	-8*	19*
Haiwee Res.	3,825	59.3	40	80	104	15	32.8*
Independence	3,950	58.4	39	80	107	11	32.8
Keeler	3,620	59.0	40	80	109*	13*	34.0*
Lake Sabrina	9,100	38.0*	27*	56*	85*	1*	19.5*
Lone Pine	3,730	59.0*	40*	81*	107*	12*	32.8*
Lundy Lake	7,760	45.0*	26	63	90*	-1*	21.0*
Mono Lake	6,450	47.7	30	67	93	3	23.4*
South Lake	9,620	39.1	26*	55*	83*	-1*	18*
White Mtn. #1	10,150	33.6	20	52	74	-17	16*
White Mtn. #2	12,470	27.6	15	46	63	-23	11*

*estimated

Table N

FROST DATA

Station	Elevation (feet)	Ave. Date of Last 32°F Spring Frost	Ave. Date of First 32°F Fall Frost	Length of Growing Season[1] (days)	Length of Frost-free Season[2] (days)	Latest Date of 32°F Spring Frost	Earliest Date of 32°F Fall Frost
Benton	5,460	May 15*	Oct. 15*	170*	155*	June 13*	Sept. 5*
Bishop	4,100	May 5	Oct. 20	190	165	June 1	Sept. 20
Bishop Creek	8,150	June 5*	Sept. 23*	135*	110*	June 28*	Aug. 20*
Bishop Union Carbide	9,390	June 10	Sept. 18	121	100	June 28	Aug. 17
Bodie	8,370	June 29	July 3	8	4	June 30	July 1
Ellery Lake	9,600	June 15*	Sept. 13*	110*	90*	June 30*	Aug. 12*
Gem Lake	9,120	June 15*	Sept. 13*	110*	90*	June 30*	Aug. 15*
Haiwee Res.	3,825	Apr. 4	Nov. 11	263	221	Apr. 22	Sept. 30
Independence	3,950	Apr. 19	Nov. 1	230	195	May 7	Oct. 13
Keeler	3,620	Apr. 5*	Nov. 15*	270*	225*	Apr. 20*	Oct. 15*
Lake Sabrina	9,100	June 8*	Sept. 21*	125	105*	June 28*	Aug. 18*
Lone Pine	3,730	Apr. 19*	Oct. 31*	230*	195*	May 7*	Oct.13*
Lundy Lake	7,760	June 1*	Sept. 28*	145*	120*	June 27*	Aug. 20*
Mono Lake	6,450	May 24	Sept. 27	156	125	June 26	Aug. 22
South Lake	9,620	June 12*	Sept. 15*	115*	95*	June 30*	Aug. 15*
White Mtn. #1	10,150	June 27	July 5	45	8	June 30	July 1
White Mtn. #2	12,470	June 26	July 4	37	8	June 30	July 1

* estimated

[1] Growing season is defined as number of days between dates of last 28° spring night and first 28° fall night.

[2] Frost-free season is defined as number of days between dates of last 32° spring night and first 32° fall night.

Table O

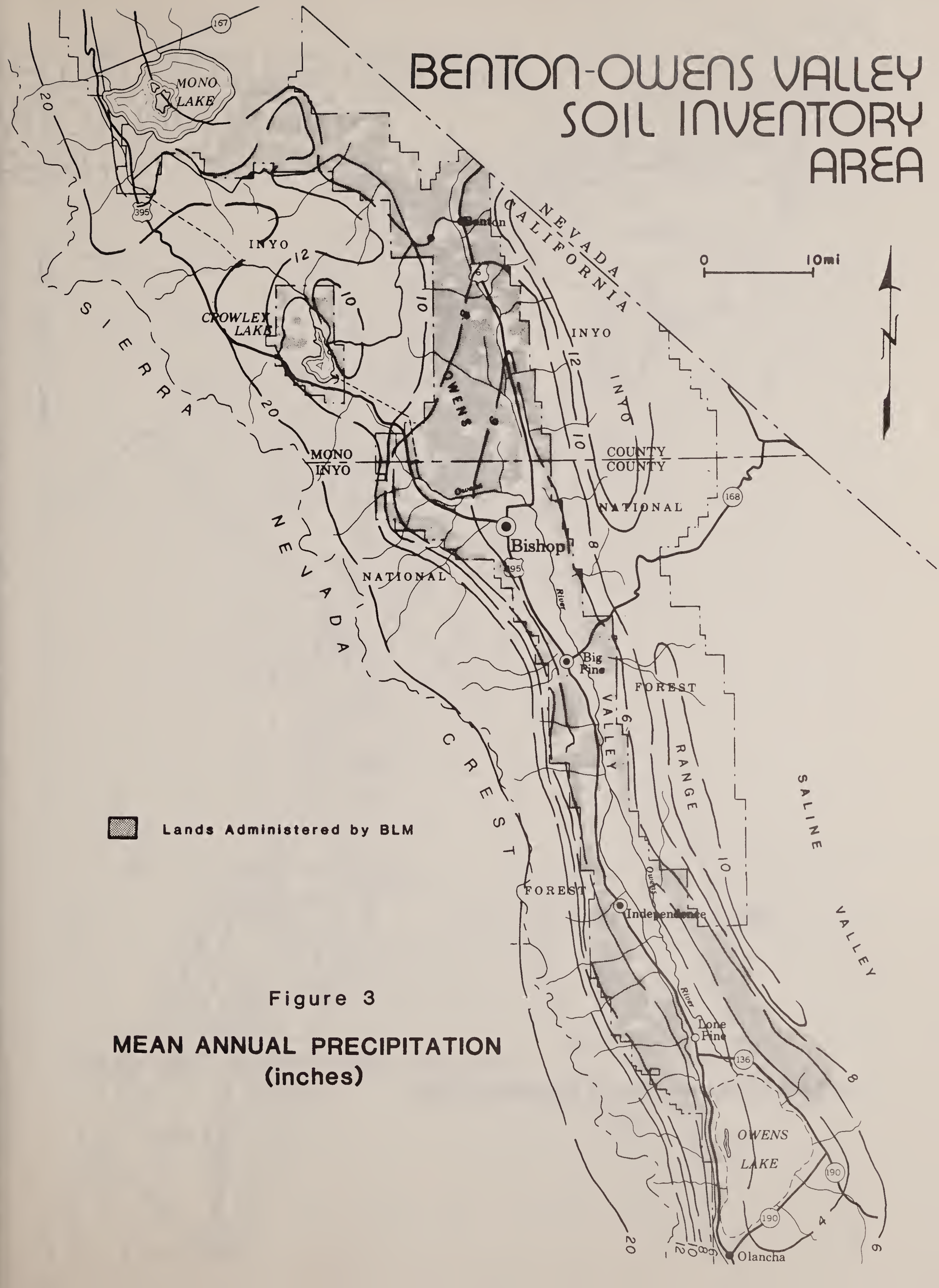
WIND DATA
Prevailing Wind Direction by Month

Station	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Bishop	n.	n.	s.	n.	n	ne.	s.	sw.	s.	s.	s.	n.	s.
Bishop Creek	s.	s.	s.	s.	s.	s.	s.	s.	s.	n.	s.	s.	s.
Haiwee Res.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	n.	n.	s.
Independence	nw.	nw.	nw.	nw.	nw.	nw.	se.	se.	nw.	nw.	nw.	nw.	nw.
Lone Pine	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.

Average Hourly Wind Movement by Month

Station	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Independence	6.4	7.2	9.1	8.8	8.9	7.9	7.1	6.5	6.4	6.3	6.3	6.6	7.3

BENTON-OWENS VALLEY SOIL INVENTORY AREA



Lands Administered by BLM

Figure 3

MEAN ANNUAL PRECIPITATION (inches)

Figure 4.

MEAN ANNUAL AIR TEMPERATURE (°F)

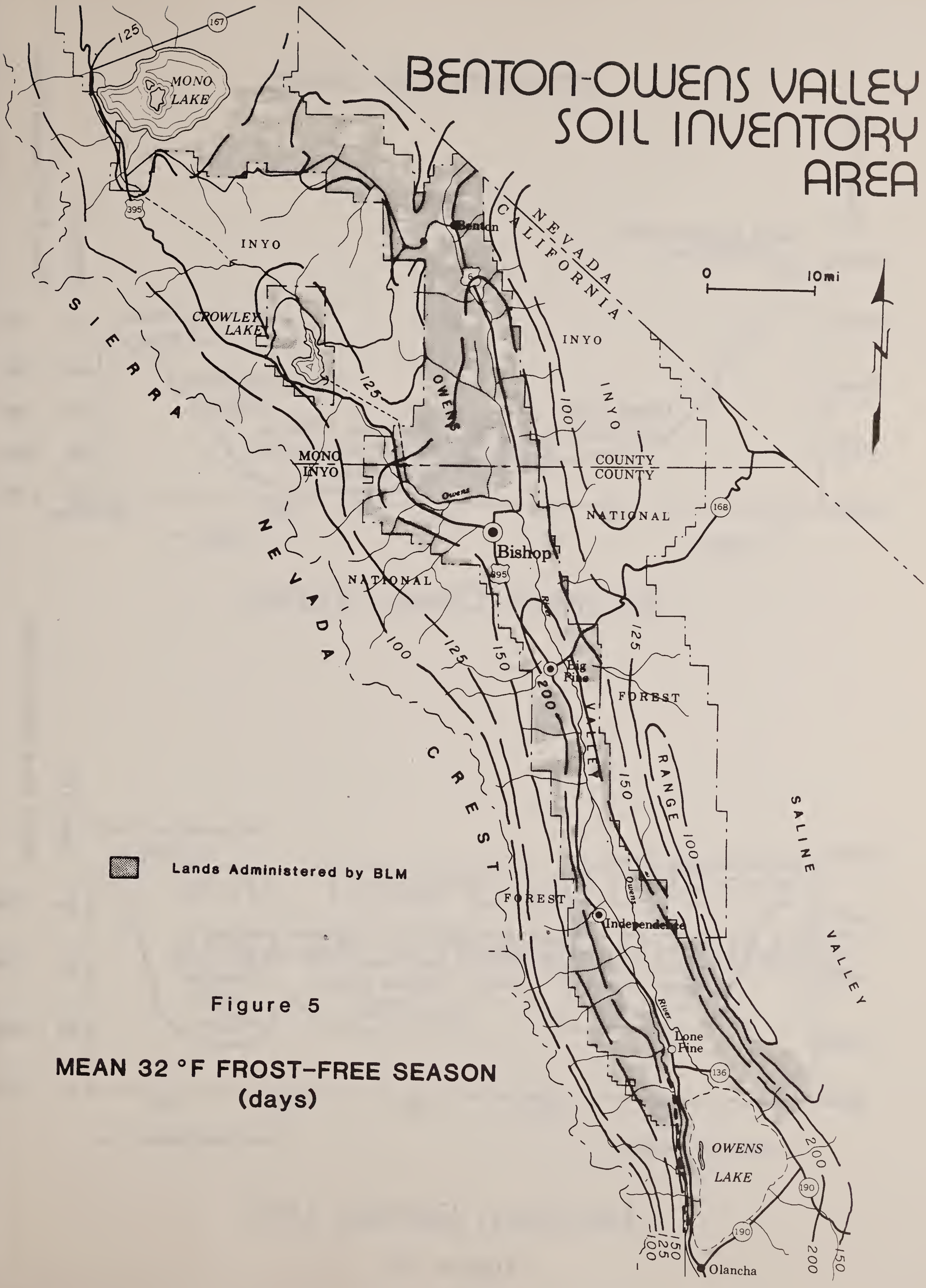
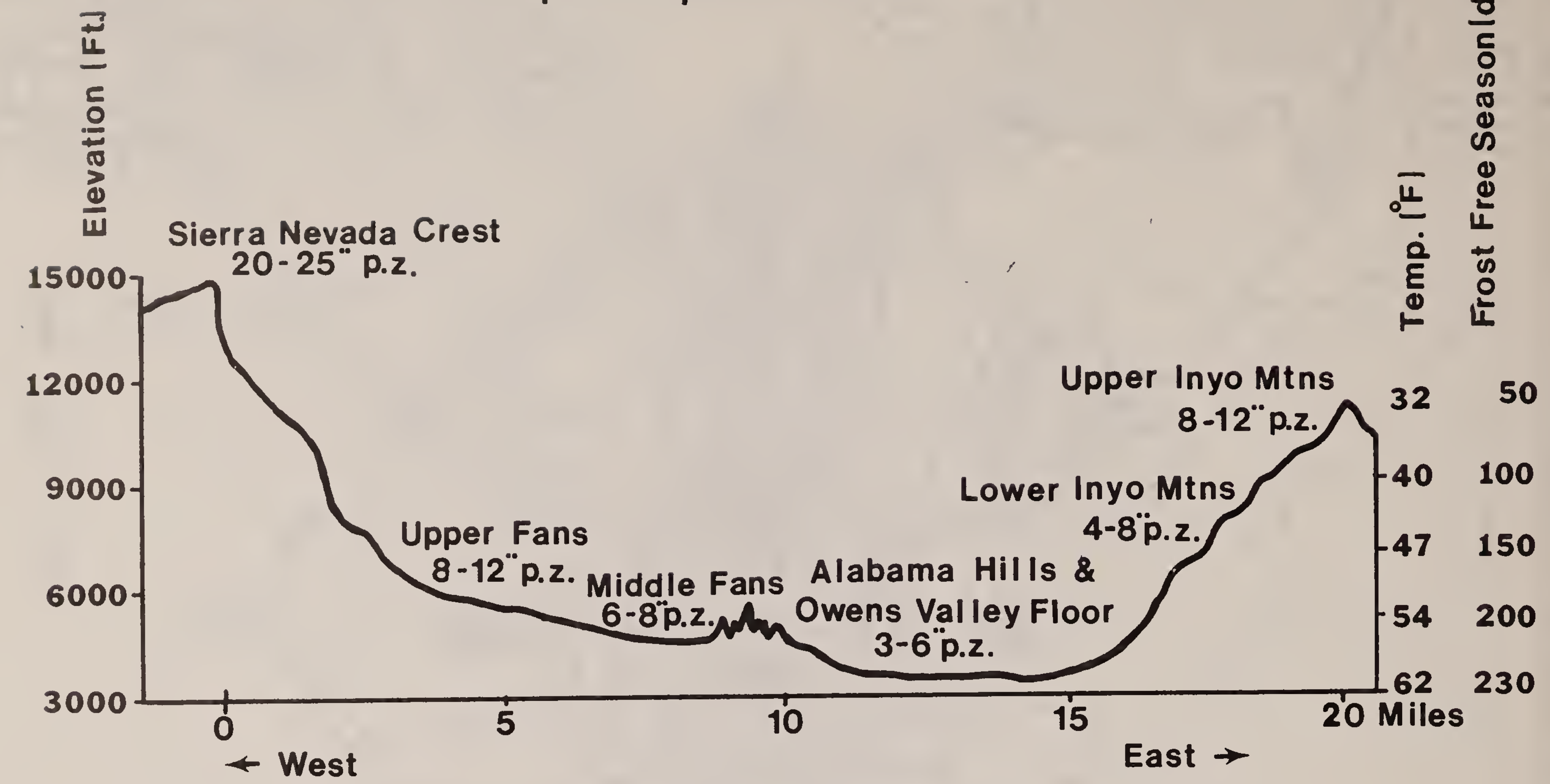


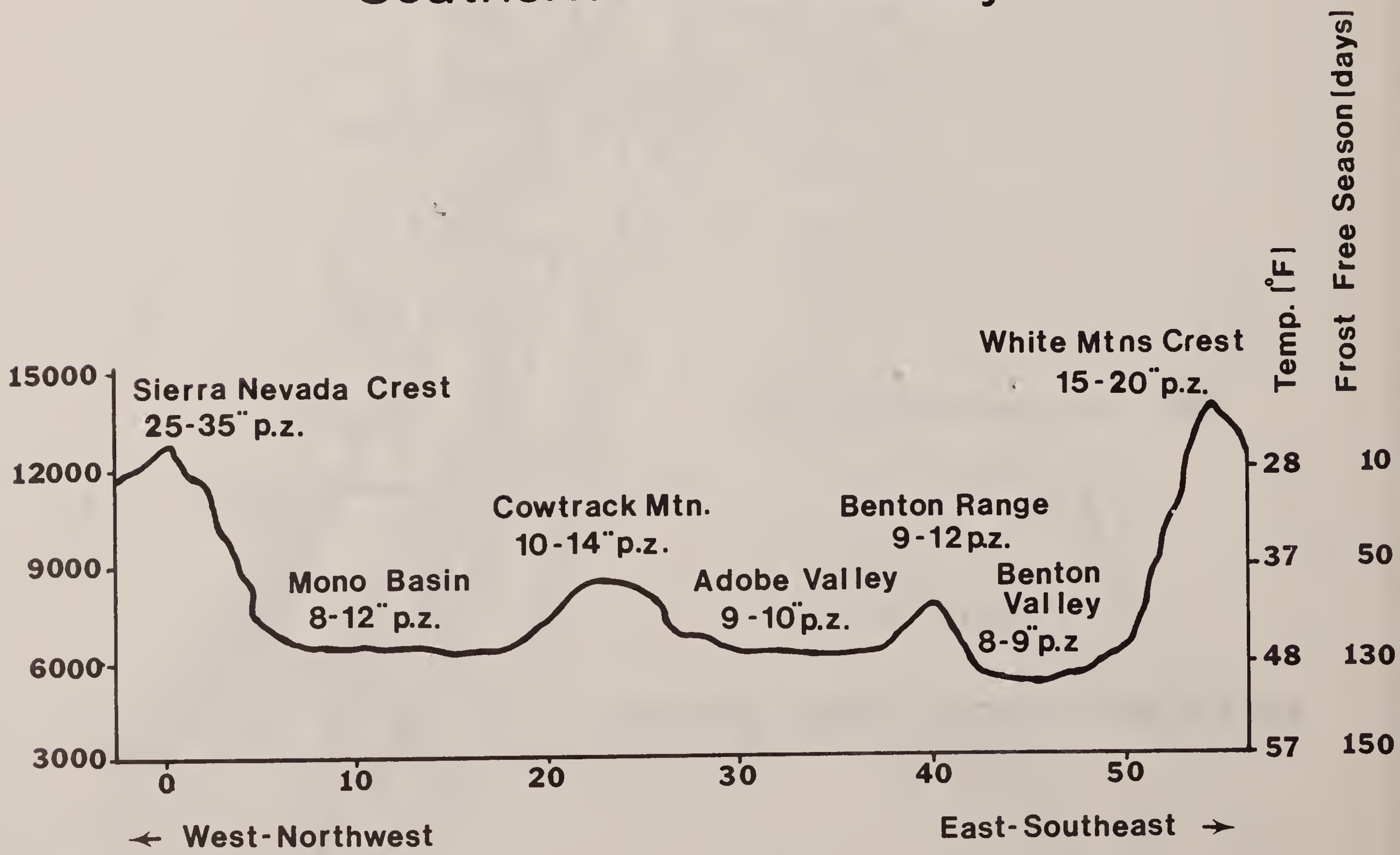
Figure 5

MEAN 32 °F FROST-FREE SEASON (days)

precipitation zones



Southern Owens Valley



Northern Benton Unit

Figure 6

SOIL TEMPERATURE AND MOISTURE REGIMES

SOIL TEMPERATURE AND MOISTURE REGIMES

major input for this section by Daniel C. Cressy

The atmospheric climate and properties of the soil combine to determine the soil climate. Soil temperature and moisture regimes affect biological processes in the soil such as root growth, rates of weathering and soil formation, and physical properties in some cases. Soil temperature and moisture regimes were determined for the soils in the inventory area according to the criteria in U.S.D.A. Handbook 436, Soil Taxonomy.[5] The soil temperature and moisture regimes of the inventory area are based on actual soil temperature field data, a vegetation survey conducted by the Bureau of Land Management concurrently with the soil inventory, and climatological records from 1956 through 1978 published by the National Oceanic and Atmospheric Administration.[3] Soil temperature and moisture data was collected monthly from October 1977 to November 1978 at 19 sites spread throughout the inventory area. Soil temperature transects were conducted that included many additional sites on April 15, 1978, October 15, 1978, April 15, 1979, and the summer months of 1980.

TEMPERATURE REGIMES

Soil temperatures were taken at a depth of 20 inches on 19 representative soils in the inventory area. Mean annual soil temperatures (MAST) were calculated by averaging the 12 monthly readings from October 1977 to October 1978, and also by applying formulas developed by Dr. Rod Arkley, soil morphologist at U.C. Berkeley to the mid-April and mid-October soil temperature readings (see Table P). These formulas are:

MAST = 13.08 + 0.8315 (mid-April soil temperature at 20 inches)
MAST = 7.21 = 0.7906 (mid-October soil temperature at 20 inches)

For the 19 monthly sites, MAST determinations using Rod Arkley's formulas closely matched the 12 month averages with differences of 3°F or less for 46 out of 53 readings. The formulas, therefore, proved valuable in extending MAST determinations to areas and slope exposures not covered by the 19 monthly sites.

Transects of different areas were analyzed separately. The sites were plotted on graphs with MAST and elevation coordinates. Function lines were then drawn for each area. From these lines the temperature regime boundaries were estimated and a soil temperature regime map was drawn (see Figure 7). This map was compared to the vegetation map and indicator species were established for extrapolation purposes. The soil temperature regime boundaries were later slightly adjusted to correspond more closely with major vegetation breaks. Four soil temperature regimes were found in the inventory area:

Regime	Mean Annual Soil Temperature
Thermic	59-72°F (hot)
Mesic	47-59°F (cool)
Frigid	32-47°F (cold with mild summers)
Cryic	32-47°F (cold with cool summers)

At a depth of 20 inches, soil temperatures in the mesic regimes dip below 47°F from mid-November through March or mid-April and are below 41°F from mid-December until sometime in March. The frigid and cryic regimes are even colder. The cryic regime has the same MAST range as frigid along with the additional requirement of having average summer soil temperatures of 59°F or less under open ground and 47°F or less under tree canopies. Much of the time that the mesic, frigid, and cryic soils are moist (December-April), they are also too cold for shallow-rooted plant growth. This may be one reason for the existence of the many deeper-rooted shrubs in the area.

The thermic-mesic line extends from about 5,500 feet in the southern Owens Valley on the west side to about 4,800 feet in Round Valley, the northwest arm of the Owens Valley. The thermic-mesic line climbs to about 6,300 feet in the Volcanic Tablelands. Big sagebrush seems to be an excellent indicator of the mesic and frigid regimes. Where it becomes the dominant shrub is usually very close to the calculated thermic-mesic line. A scattering of big sagebrush occurs for a short elevation drop below the line. Caution was needed in using big sagebrush as an indicator species in some areas because big sagebrush will grow well in the thermic zone in drainages where it can tap deep moisture. In the Inyo Mountains, big sagebrush does not become dominant until 6,400 to 6,800 feet, which agrees with the calculated thermic-mesic line. Strangely, some of the upper Volcanic Tablelands near Casa Diablo Mountain do not support big sagebrush below 6,000 feet while adjacent areas do. This may be due to the fire history and plant succession in the area.

The mesic-frigid line occurs at about 9,000 feet in the Inyo Mountains and around 7,800 feet in the Cowtrack-Granite Mountain area. In shallow, rocky soils, curlleaf mountainmahogany is an indicator of frigid or near-frigid conditions. The tree co-exists with singleleaf pinyon pine. The calculated mesic-frigid line has been lowered slightly in places in the Inyo Mountains to include most of the mountainmahogany. Lupines may be indicators of frigid on the deep and moderately deep ashy soils of Cowtrack Mountain.

The frigid-cryic lines are based on the mean summer temperatures of 1980. The mean summer soil temperatures were calculated by averaging the mid-June, July and August soil temperatures (see Table Q). The Cowtrack Mountain frigid-cryic line for that year was about 7,800 feet. For the Inyo Mountains it was 9,500 feet. Air temperatures were abnormally cool for late spring and early summer of 1980, however, so the line was adjusted to a normal year. Pinyon pine and mountainmahogany give way to limber pine and bristlecone pine at 9,600 to 9,800 feet on the shallow, rocky soils of the Inyo Mountains. This vegetation break was chosen for the frigid-cryic line in that area. On the deeper soils of Cowtrack Mountain, no indicator species were evident for cryic. The shallow soils of Granite Mountain also showed no vegetation break for cryic, with mountainmahogany and pinyon pine growing up to the summit (8,920 feet). The frigid-cryic line was placed at 8,600 feet after applying a correction based on differences between the summer soil temperatures of 1978 and 1980 at the adjacent monthly sites in the mesic zone.

Four conclusions were drawn from analyzing the data. One is that this area seems to have warmer soil temperatures than other areas in the region. This may be due to the fact that the area borders on the Mojave Desert, and also that the high mountain ranges surrounding the area reduce air circulation, helping to keep the area warmer. Two, soil temperatures decrease slightly for

a given elevation going from south to north in Owens Valley. Another conclusion is that soil temperatures on the east side of Owens Valley are condiserably warmer than the west side for a given elevation. The west slopes of the Inyo Mountains on the east side of the valley bake in the afternoon sun, while the east slopes of the Sierra Nevada and its alluvial fans receive less solar radiation because of their aspect. It is interesting to note that the plotted data for MAST and summer temperatures of the Inyo Mountains show that the soil temperatures cooled at a very slow rate of 1.7°F/1,000 feet going up slope to about 6,500 feet elevation. There the rate abruptly changed to 5°F/1,000 feet up to the crest. The fourth conclusion is that poorly drained soils with high water tables are considerably cooler than surrounding soils.

MOISTURE REGIMES

Moisture samples were collected in sealed cans for the 19 monthly sites when necessary. For each site one sample was taken at the top and one at the bottom of the moisture control section (usually 14 to 40 inches). Unfortunately the data was collected during the tail end of a prolonged, sever drought and during as exceptionally moist year which followed. Consequently, the data was of little value in determining the soil moisture regimes. Climatological records and vegetation had to be relied on heavily. Precipitation ranges were assigned to vegetation communities that had been grouped into separate range sites. The precipitation ranges are based on extrapolation of precipitation data, taking into account the vegetation and the effects of topography.

Precipitation lapse rates were calculated to facilitate the extrapolation. On the west side of the Owens Valley a lapse rate of 1.6 inches of precipitation per 1,000 feet elevation gain was used. This figure was derived from the differences of precipitation and elevation between the Bishop Airport and the Bishop Creek Intake Station No. 2 on the lower Sierra Nevada escrapment. A lapse rate of 0.95 inches of precipitation per 1,000 feet elevation gain was assigned to the eastern side of the Owens Valley. In deriving this figure, the top of Mount Inyo (11,107') was estimated to have a precipitation of 12 inches based on a 1:1,000,000 isohyetal map of California.

After the precipitation zones were set up, the Thornthwaite[6] method for calculating potential evapotranspiration was used on temperature data from the Mono Lake, Benton, Bishop, and Haiwee Reservoir stations. A month-by-month graph of potential evapotranspiration vs. precipitation was then made at each station (see Figures 9, 10, 11, 12). The potential evapotranspiration lapse rate for most of the survey area was 2.05 to 2.75 inches per 1,000 feet of elevation. Knowing the dates when the soil warms and cools below 5° and 8°C, the periods of moisture availability for plant use were estimated. A soil moisture regime map was made (see Figure 8). The moisture regimes with their respective precipitation zones and vegetation communities are:

Aridic

4 to 6 inches precip. zone - saltbush communities represented by white bursage, shadscale, allscale saltbush, and creosotebush. The soil is partially moist during the winter months and dry the rest of the time. This regime is present in southern Owens Valley and along the eastern side of the valley, extending partially into the Inyo Mountains.

Aridic-bordering-on-Xeric

6 to 8 inch precip. zone - mixed desert shrub communities represented by spiny hopsage, Nevada ephedra, blackbrush, and Fremont dalea.

8 to 12 inch precip. zone - big sagebrush communities represented by Wyoming big sagebrush, desert bitterbrush, and singleleaf pinyon.

10 to 14 inch precip. zone - big sagebrush communities represented by basin big sagebrush, antelope bitterbrush, and singleleaf pinyon.

The soil is moist for slightly longer periods than the aridic regime; or it is continuously moist for 4 to 5 months in winter and spring, but the moisture is mostly unavailable to plants due to the cold soil temperatures at the time. This is the most prevalent regime in the survey area. It occurs throughout most of the Benton Unit, on the west side of Owens Valley, and in much of the Inyo Mountains.

Aquic

The soil has a fluctuating high water table that comes up near or at the soil surface during the spring and early summer. Aquic regimes are restricted to small areas on valley floors, artesian spring areas, and areas near flowing streams.

Aridic bordering on Aquic - The soil has a fluctuating high water table that comes up within 3 to 5 feet of the soil surface in the spring and summer, and then falls below this during the rest of the year. The soil is moist throughout the summer and fall due to capillary rise of water from the water table. This regime is associated with the aquic regime.

Discussion

Figures 9, 10, 11, and 12 summarize the results using the Thornthwaite method. For an aridic regime, the moisture control section must be dry in all parts three-forths or more of the time (cumulative) that the soil temperature at a depth of 20 inches is above 8°C. The aridic-bordering-on-xeric regime has the same requirements except that the moisture control section must be dry in all parts from one-half to three-forths of the time (cumulative) that the soil temperature at a depth of 20 inches is above 5°C.

Benton Inspection Station and Mono Lake fall comfortably within the aridic-bordering-on-xeric moisture regime. It was concluded that the 8 to 12 inch precipitation zone and much of the 10 to 14 inch zone are aridic-bordering-on xeric. It was ruled out that Cowtrack Mountain with its estimated mean annual precipitation of 14 inches could be xeric because the slight precipitation increase is probably offset by the colder temperatures. Consequently, the number of consecutive days when the soil moisture control section is moist in at least some part should still be less than 90, when the soil temperatures are above 8°C.

Bishop Airport and Haiwee Reservoir barely made aridic-bordering-on-xeric. They almost met the requirements to be aridic. For most of the 4 to 6 inch precipitation zone, evapotranspiration is more than what it is in Bishop, and precipitation is less.

Considering this and allowing for margins of error using the Thornthwaite method it was decided that the 4 to 6 inch precipitation zone was aridic. The 6 to 8 inch precipitation zone was designated aridic-bordering-on xeric. The soils with aquic moisture regimes have been observed to have standing water or a water table within one meter of the surface during the summer months. Except for the severe drought of 1976-1977, the surfaces of these soils have always been moist when observed. It is presumed that the whole soil is saturated with water for more than a few days in the spring. Salt crusts in many areas are evidence that the capillary fringe of the water table reaches the surface. Typically, the wettest of these soils support sedges, reeds, and grasses. At the drier end of the aquic moisture regime the soil supports salt grasses and scattered rubber rabbitbrush.

The soils with an aridic-bordering-on-aquic moisture regime have been observed to have water tables at 3 to 5 feet during some time of the year, or at least have shown evidence of a water table by soil mottling. Inland saltgrass and rubber rabbitbrush are the usual vegetation.

Table P

Mean Annual Soil Temperature at 20"
Benton-Owens Valley Soil Inventory Area

Site and Location	Elev. (ft.)	Slope (%)	Aspect	Main Vegetation	MAST 1/ 12 mo. Ave. 10/77-10/78	MAST 1/ Rod Arkley 4/15/78	MAST 1/ Rod Arkley 10/15/78	MAST 1/ Rod Arkley 4/15/79
Lone Pine-Sec 15, T16S, R36E	3,780	4	E	White bursage, shadscale, allscale saltbush	65-t	63-t	65-t	65-t
Whitney Portal Rd-Sec 30, T15S, R34E	6,400	10	E	Big sagebrush, desert bitter-brush, rubber rabbitbrush	56-m	54-m	52-m	55-m
Independence-Sec 27, T12S, R34E	3,900	0	-	Allscale saltbush, big sagebrush	64-t	63-t	62-t	65-t
Waucoba Rd-Sec 26, T19S, R35E	6,400	12	NW	Saltbrush, longspine horsebrush, spiny hopsage	59-t/m	59-t/m	56-m	57-m
Bishop Airport-Sec 4, T7S, R33E	4,110	0	-	Saltbrush	63-t	61-t	63-t	63-t
Millner Creek Rd-Sec 18, T4S, R33E	4,600	5	W	Fremont dalea, spiny hopsage, Nevada ephedra	63-t	61-t	63-t	63-t
Benton Valley-Sec 30, T1S, R32E	5,430	0	-	Big sagebrush, Nevada ephedra	57-m	55-m	55-m	56-m
Adobe Valley-Sec 2, T1S, R30E	6,675	0	-	Big sagebrush, Douglas rabbit-brush, Indian ricegrass	53-m	53-m	52-m	52-m
Granite Basin-Sec 35, T1N, R29E	7,190	3	SE	Big sagebrush	51-m	50-m	53-m	50-m
Cowtrack Mtn.-37°57'N, 118°51'W	7,700	0	-	Rubber Rabbitbrush	50-m	-	52-m	45-f
McPherson Grade-37°57'N,118°53'W	7,400	25	SW	Big sagebrush, antelope bitterbrush, rubber rabbitbrush	52-m	55-m	56-m	54-m
McPherson Grade-37°57'N,118°53'W	7,580	38	SW	Big sagebrush, antelope bitterbrush, rubber rabbitbrush	53-m	55-m	56-m	-
Big Sand Flat-Sec 3, T1S, R28E	7,895	0	-	Grasses	48-m	42-f	50-m	44-f
Big Sand Flat-Sec 9, T1S, R28E[2]	7,870	0	-	Grasses, lupines, sedges	44-f	43-f	47-f/m	-
Mono Mills-Sec 2, T1S, R27E[3]	7,360	0	-	Jeffrey pine, big sagebrush	45-f	44-f	47-f/m	40-f

Table P (Cont.)

Mean Annual Soil Temperature at 20"
Benton-Owens Valley Soil Survey Area

Site and Location	Elev. (ft.)	Slope (%)	Aspect	Main Vegetation	MAST 1/ 12 mo. Ave. 10/77-10/78	MAST 1/ Rod Arkley 4/15/78	MAST 1/ Rod Arkley 10/15/78	MAST 1/ Rod Arkley 4/15/79
Mono Basin-Sec 13, T1N, R27E	6,660	0	-	Big sagebrush, Antelope bitterbrush, rubber rabbitbrush	52-m	51-m	55-m	53-m
Mono Basin-Sec 14, T1N, R27E	6,450	0	-	Antelope bitterbrush, big sagebrush, rubber rabbitbrush	53-m	53-m	55-m	54-m
Pumice Valley-Sec 10, T1S, R26E	7,100	13	S	Big sagebrush, Antelope bitterbrush	51-m	-	55-m	48-m
Lee Vining-Sec 8, T1N, R26E	6,900	30	E	Big sagebrush, singleleaf pinyon pine	50-m	50-m	53-m	47-f/m

1/ t = thermic
m = mesic
f = frigid

[2] poorly drained soil

[3] under Jeffery pine canopy

Table Q

1980 AVERAGE SUMMER SOIL TEMPERATURE (°F)[1]

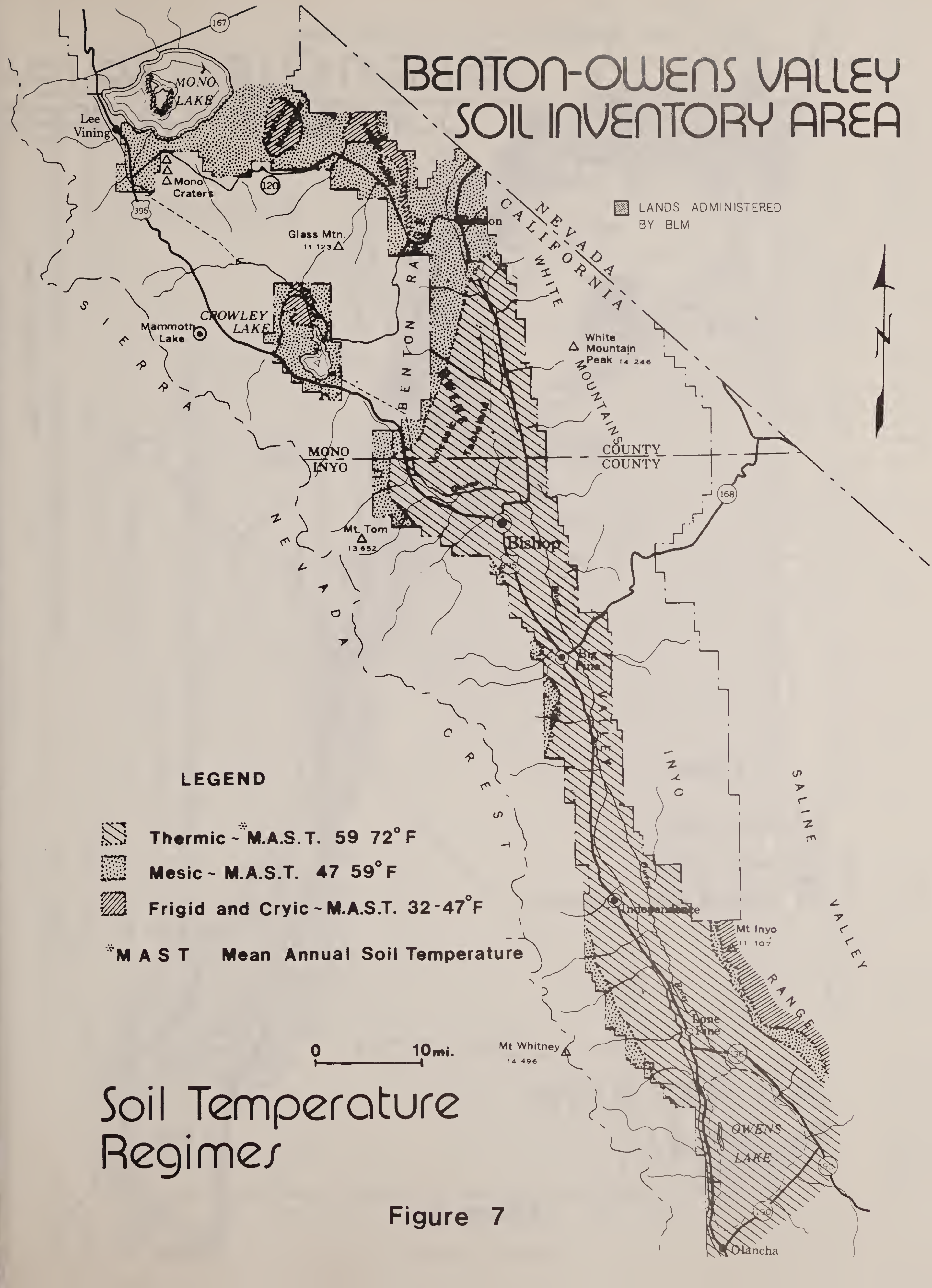
Cowtrack Mountain Area

Elevation (ft.)	June 15	July 15	Aug. 15	Ave. Temp.
9,000	45.0	55.5	57.2	52.6
8,750	46.0	56.8	58.4	53.7
8,500	47.8	58.2	59.8	55.3
8,250	49.1	59.6	61.1	56.6
8,000	50.4	61.0	62.4	57.9
7,750	51.7	62.4	63.8	59.3
7,500	53.1	63.6	65.0	60.6

Inyo Mountains

Elevation (ft.)	June 15	July 15	Aug. 15	Ave. Temp.
11,000	44.8	54.8	57.0	52.2
10,500	46.0	56.0	59.4	53.8
10,000	48.6	58.6	62.0	56.4
9,500	51.2	61.2	64.4	58.9
9,000	53.8	63.8	66.9	61.5
8,500	56.4	66.4	69.4	64.0
8,000	59.0	69.0	71.9	66.6

1 Temperatures were taken at a depth of 20 inches on nearly level slopes. Soils in the Cowtrack Mountain area were the Cowtrack, Pizona, and Zono series. Soils in the Inyo Mountains were frigid and mesic Haplargids or Torriorthents, and Cryoborolls.



BENTON-OWENS VALLEY
SOIL INVENTORY AREA
LANDS ADMINISTERED BY BLM
MONO LAKE
Lee Vining
Mono Craters
Glass Mtn. 11 123
CROWLEY LAKE
Mammoth Lake
SIERRA NEVADA CREST
BENTON RA
NEVADA
CALIFORNIA
WHITE MOUNTAINS
White Mountain Peak 14 246
MONO
INYO
COUNTY
COUNTY
Mt. Tom 13 652
Bishop
Big Pine
INYO
SALINE VALLEY
Independence
Mt Inyo 11 107
RANGE
Lone Pine
Mt Whitney 14 496
OWENS LAKE
Olancha
LEGEND
Thermic ~ *M.A.S.T. 59 72°F
Mesic ~ M.A.S.T. 47 59°F
Frigid and Cryic ~ M.A.S.T. 32-47°F
*M A S T Mean Annual Soil Temperature
0 10mi.
Soil Temperature Regimes

Figure 7

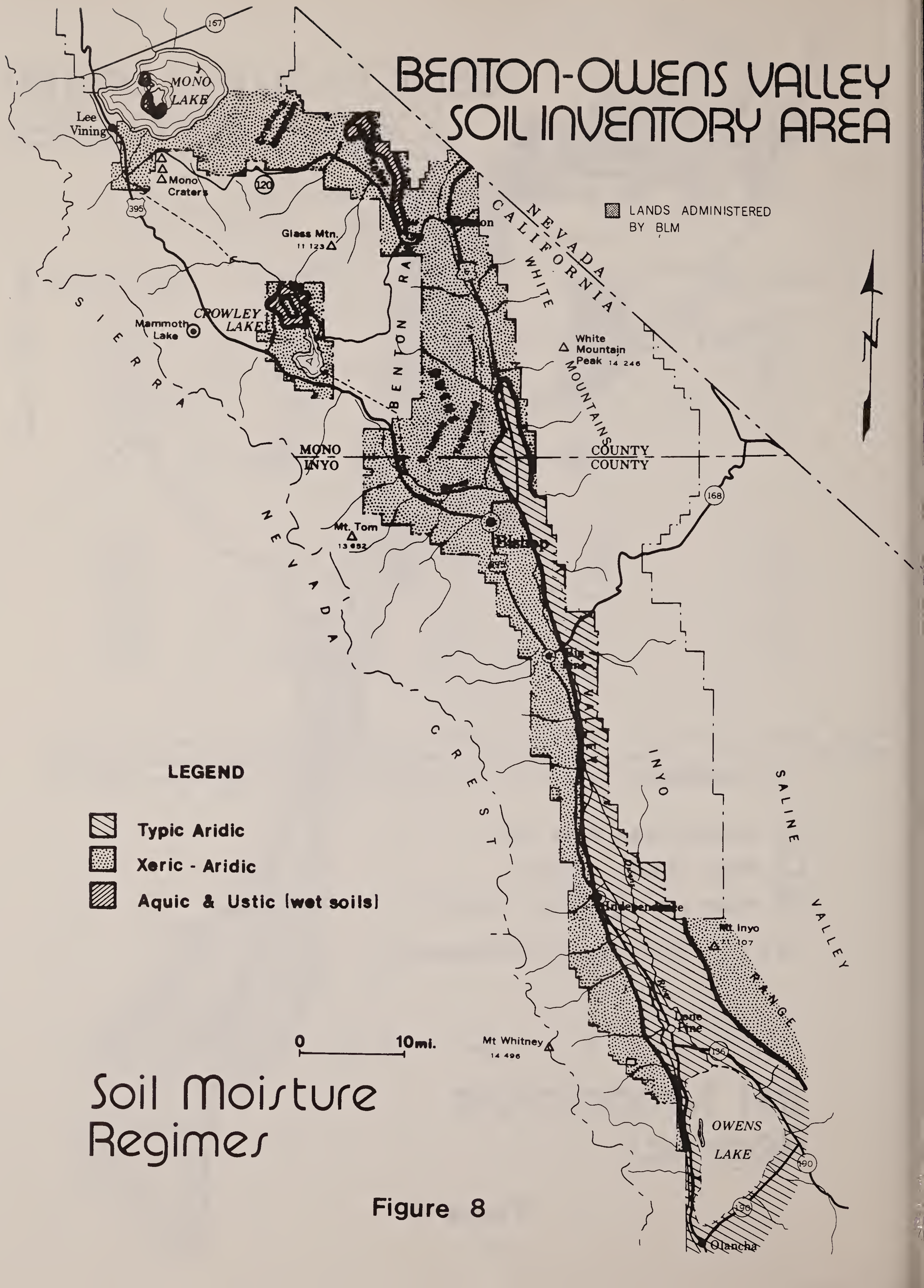
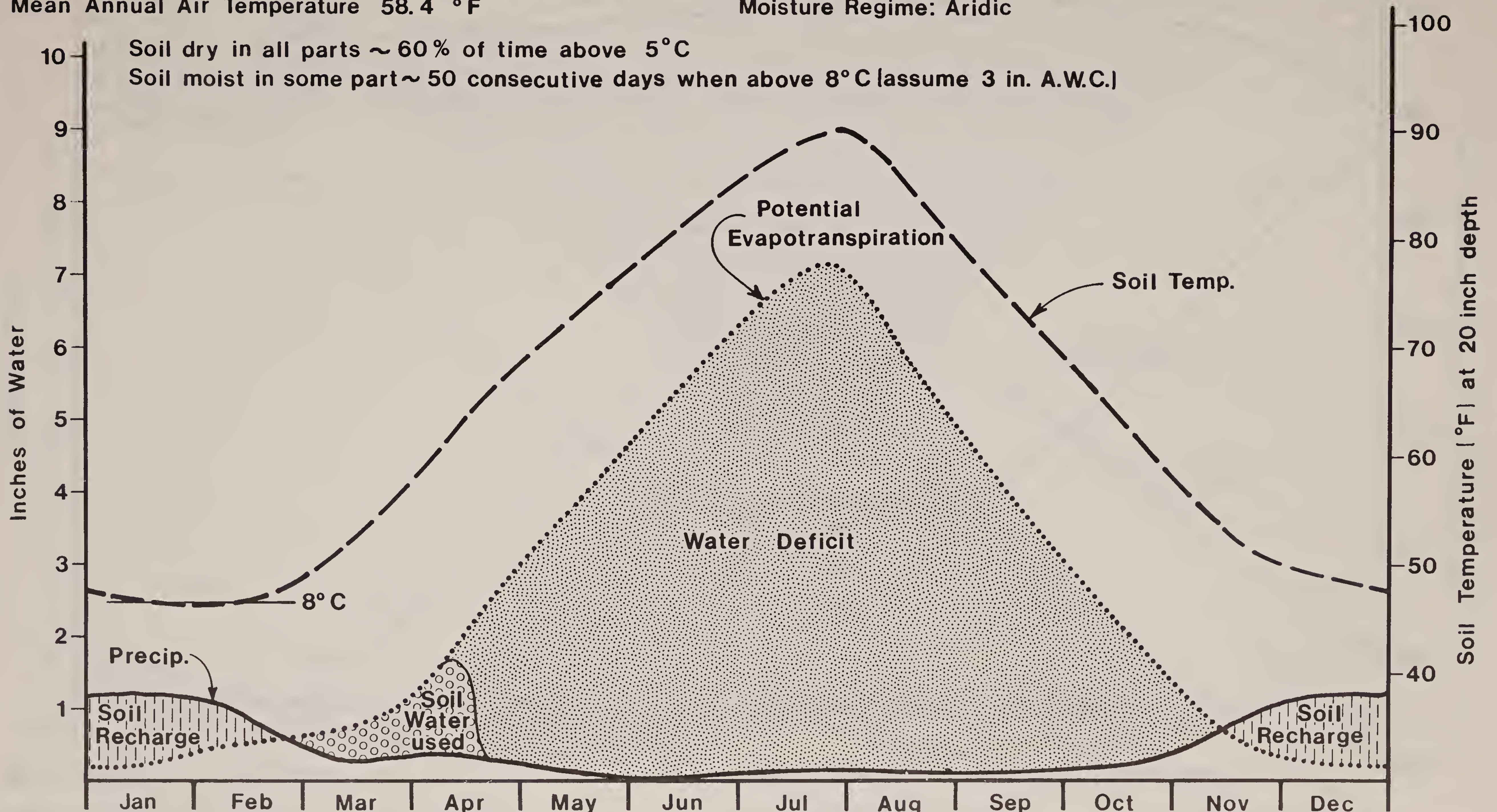

BENTON-OWENS VALLEY
SOIL INVENTORY AREA
LANDS ADMINISTERED BY BLM
MONO LAKE
Lee Vining
Mono Craters
Glass Mtn. 11 123
CROWLEY LAKE
Mammoth Lake
SIERRA NEVADA CREST
BENTON RA
WHITE MOUNTAINS
White Mountain Peak 14 246
NEVADA
CALIFORNIA
MONO
INYO
COUNTY
COUNTY
Mt. Tom 13 652
Bishop
INYO
SALINE VALLEY RANGE
Mt Inyo 11 107
Independence
Lone Pine
Mt Whitney 14 496
OWENS LAKE
Olancha
LEGEND
Typic Aridic
Xeric - Aridic
Aquic & Ustic (wet soils)
0 10mi.
Soil Moisture Regimes

Figure 8

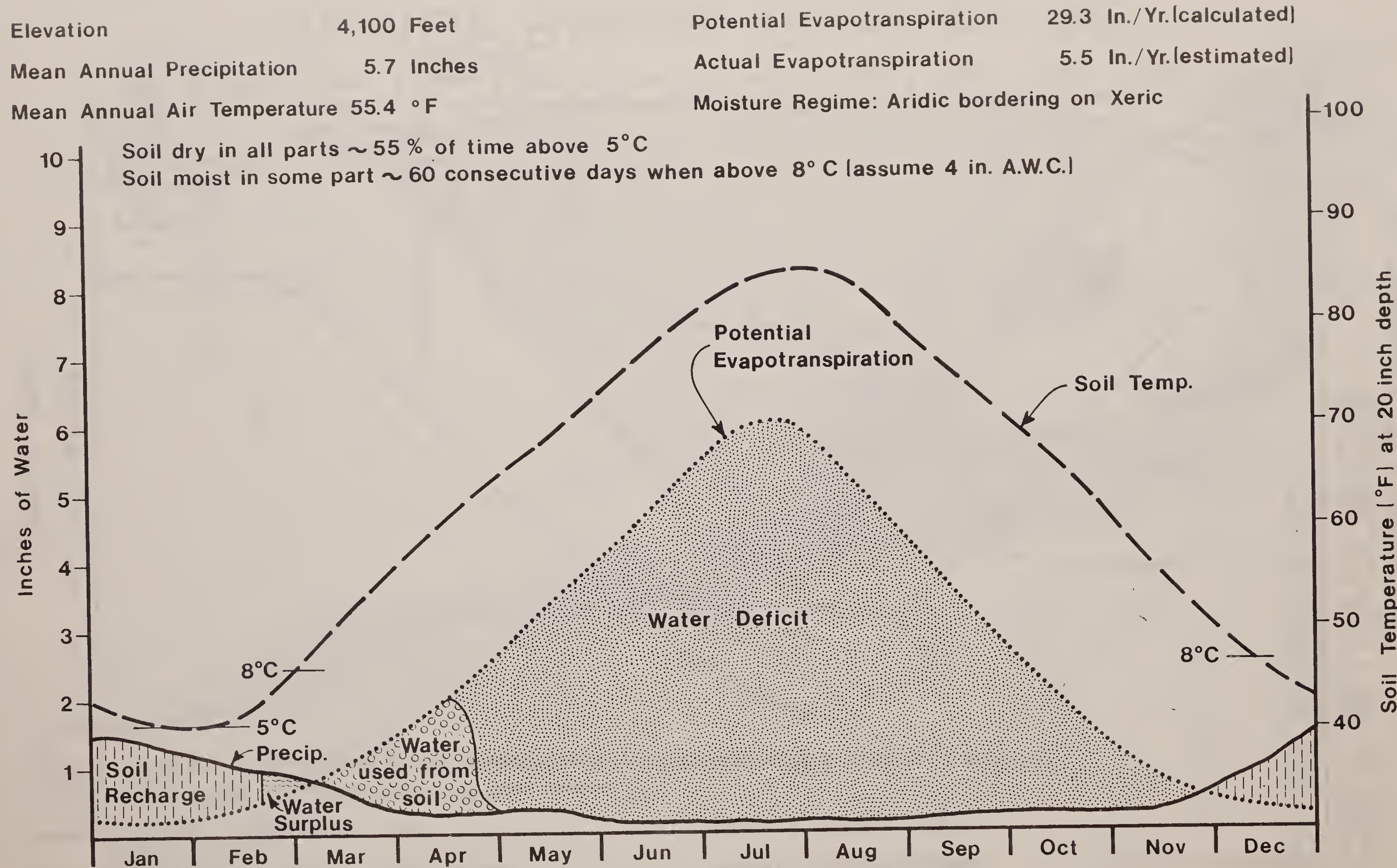
Figure 9

Elevation	3,900 Feet	Potential Evapotranspiration	32.8 In./Yr. (calculated)
Mean Annual Precipitation	5.4 Inches	Actual Evapotranspiration	5 In./Yr. (estimated)
Mean Annual Air Temperature	58.4 °F	Moisture Regime: Aridic	



Moisture Balance Graph for the Yermo Soil near Independence Weather Station

Figure 10



Moisture Balance Graph for the Thibau Soil near Bishop Airport Weather Station

Figure 11

Elevation 5,460 Feet

Mean Annual Precipitation 8.7 Inches

Mean Annual Air Temperature 50 °F

Potential Evapotranspiration 26.5 In./Yr. (calculated)

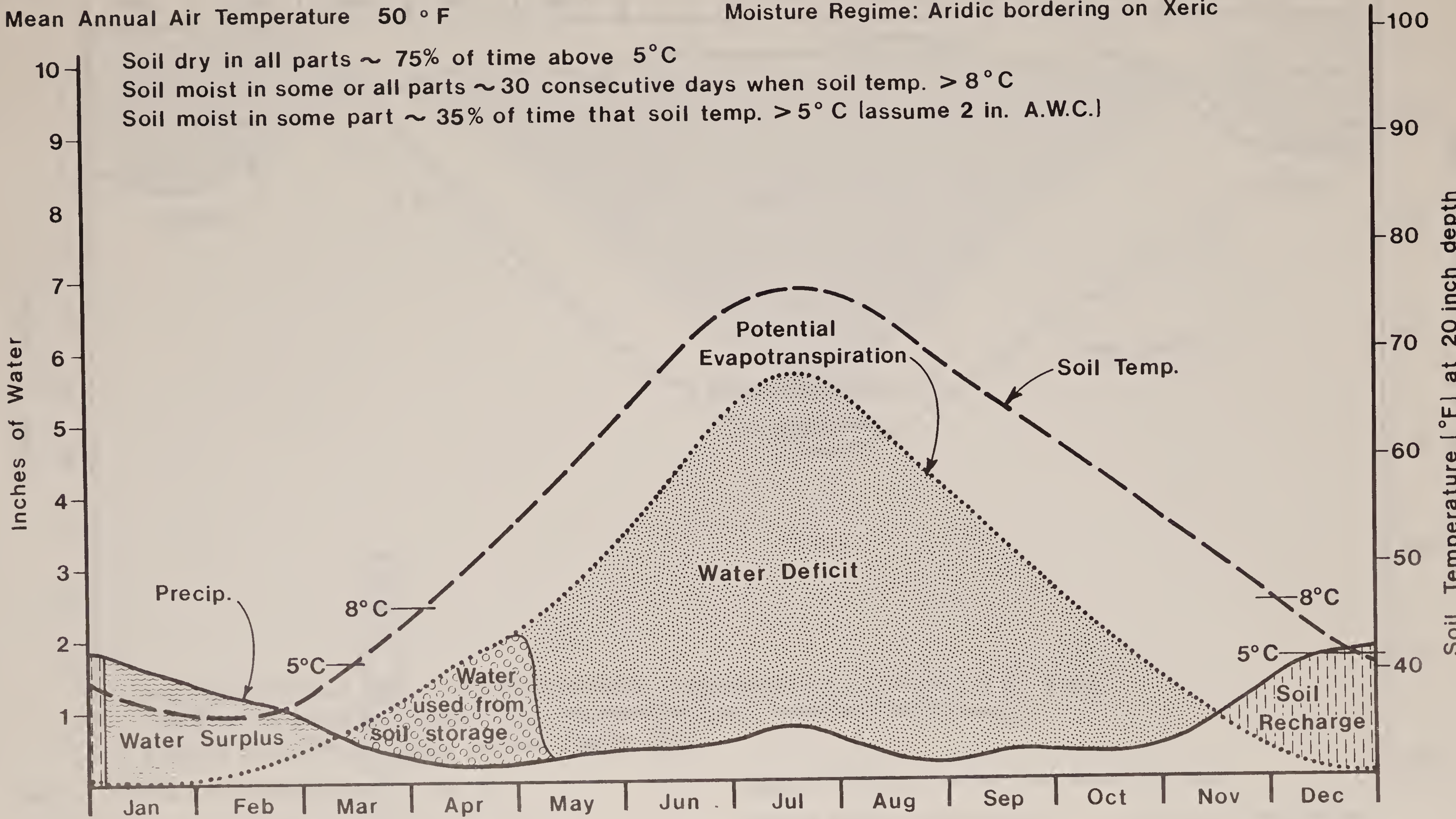
Actual Evapotranspiration 8 In./Yr. (estimated)

Moisture Regime: Aridic bordering on Xeric

Soil dry in all parts ~ 75% of time above 5°C

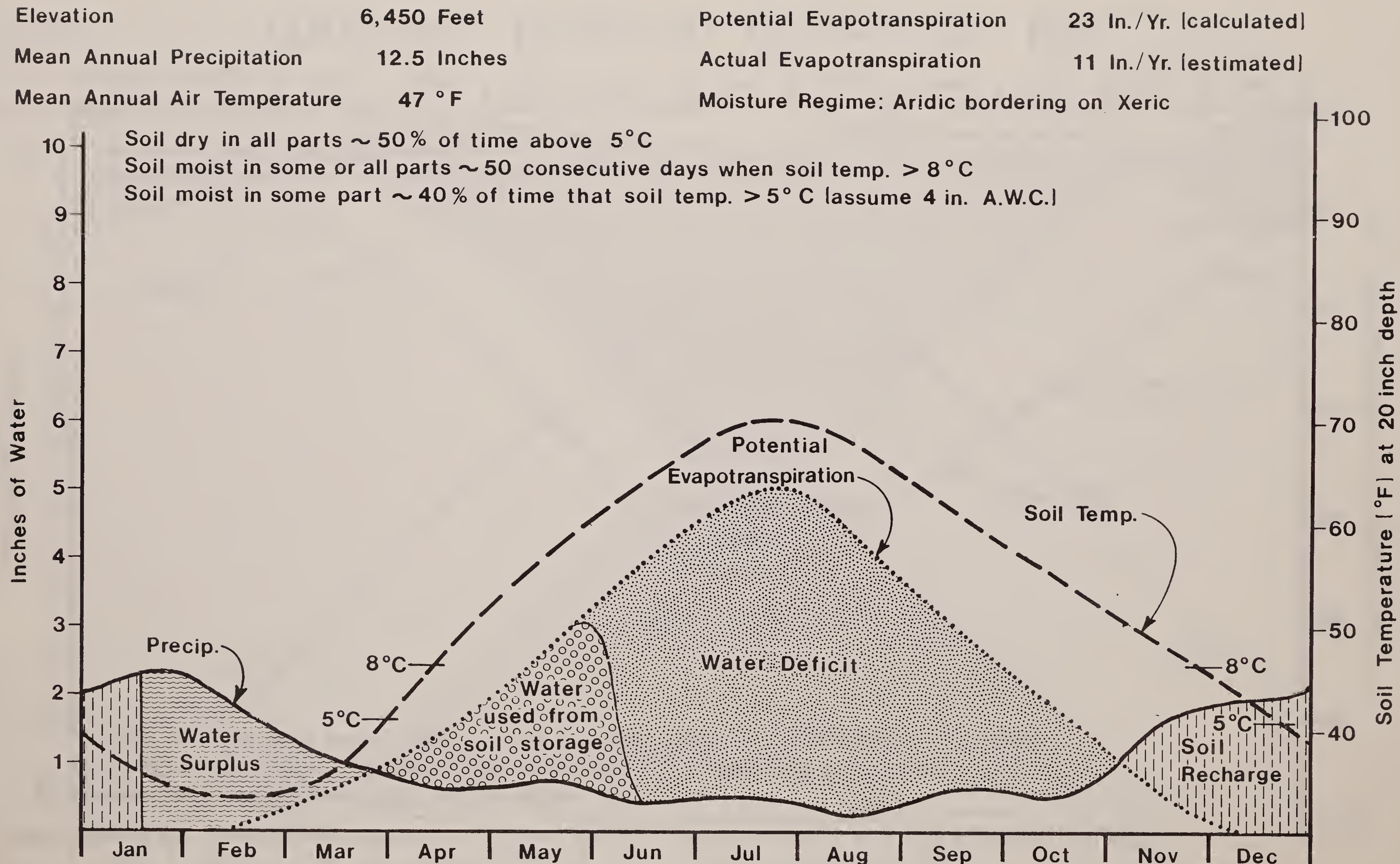
Soil moist in some or all parts ~ 30 consecutive days when soil temp. > 8°C

Soil moist in some part ~ 35% of time that soil temp. > 5° C (assume 2 in. A.W.C.)



Moisture Balance Graph for the Tuttle Soil near Benton Inspection Station Weather Station

Figure 12



Moisture Balance Graph for the Brantel Soil near Mono Lake Weather Station

GEOLOGY

GEOLOGY

The Benton-Owens Valley Area encompasses a wide variety of rock types and geomorphic processes. Metamorphic, sedimentary, and igneous rock types are represented, along with alluvial, glacial, lacustrine, and volcanic processes. See Figures 13 and 14.

The Inyo-White Mountain range is a steep, rugged chain of mountains marking the eastern boundary of the inventory area. The rock types are primarily Mesozoic, Paleozoic, and Precambrian sedimentary and metasedimentary, with some large areas of granitic rocks present near New York Butte, Waucoba Mountain, and White Mountain Peak.[7,8,9] The mountains are a typical fault block range characteristic of Great Basin mountain ranges.

Owens Valley is a long, narrow graben between the Sierra Nevada and White-Inyo Mountains which has undergone successive down-faulting while the mountain ranges on either side have been periodically thrust upward. Numerous en-echelon fault traces are present at the bases of these ranges and many examples of faceted spurs are present. Many faults are still considered active as evidenced by the 1872 earthquake at Lone Pine, which was probably the most powerful earthquake in recorded California history. Some small fault scarps from the quake are still visible near Lone Pine and Big Pine. The valley contains several thousand feet of alluvial and lacustrine sediments. A large alluvial fan apron has formed on the west side of the valley, fed by flash floods from the granitic Sierra Nevada canyons. These fans are composed of many large rock fragments in a sandy matrix, with no sorting present. This would seem to indicate that the fans were formed by large, violent flash floods instead of yearly glacial outwash from the Sierra Nevada. However, the alluvium on the fans may have partially originated from morainal deposits within the canyons. A much smaller apron is present on the east side of the valley. Between Big Pine and Independence there is a series of recent volcanic lava flows and cinder cones on the alluvial aprons. Crater Mountain and Red Mountain are the largest cinder cones. Their adjacent basaltic lava flows are rough and dark-colored, with many small lava rock outcrops. Two small sets of hills occur in the middle of Owens Valley: the scenic Alabama Hills (mostly granitic) near Lone Pine, and the Poverty Hills (mostly metasedimentary) between Independence and Big Pine. The topography and jointing of the Alabama Hills resembles that near the Mount Whitney crest, which has led some geologists to suppose that the Alabama Hills are a remnant of the pre-Sierran landscape which was not uplifted with the rest of the Sierran fault block.

Dry Owens Lake at the southern end of Owens Valley is fed by the much-reduced Owens River and has no outlet in the geologic present. However, in the Pleistocene period it is thought to have been one in a chain of freshwater lakes that originated with old Lake Russell (now Mono Lake) and Long Valley Lake. Water from Lake Russell flowed into Adobe Lake, into Benton Valley, through the Owens River, and, joining with water from ancient Long Valley Lake, into Owens Lake. From there it flowed south through Fossil Falls into Indian Wells Lake, then east into Searles Lake and Panamint Lake, and finally into ancient Lake Manly on the floor of Death Valley.[10]

Small portions of the Sierra Nevada eastern escarpment are in the inventory area and are characterized by steep, granitic mountain slopes. Two small, low elevation plateaus extend into the Owens Valley - the Warren Bench, east of Big Pine and the Tungsten Hills, east of Bishop. Several stony and bouldery glacial moraines are present along the Sierra Nevada escarpment between Bishop and Lee Vining. These terminal and lateral moraines project from the canyons of Bishop Creek, Pine Creek, Hilton Creek, McGee Creek, and Rush Creek. They are believed to represent the Tahoe and Teñaya glacial periods.

North of Bishop lies the Volcanic Tablelands, a gently rolling area of both hard and soft rhyolitic tuff that covers about 325 square miles. Geologists believe the area developed from "glowing ash flows" originating from the Long Valley area during the Pleistocene epoch. These ash flows were violently emitted, incandescent clouds of volcanic ash and gas which raced across the original ridge-valley topography at speeds of up to 100 mph and at temperatures in excess of 1200°F. The rate of cooling of the ash determined its present consistency, the hard tuff having cooled more slowly than the soft tuff. Isolated, rocky "fumarolic mounds" mark the sites of extinct gas vents which existed after the formation of the tablelands. Glowing ash flows, also known as a glowing avalanche or "nuee ardente", have been observed in recent times throughout the world. The most familiar ones are in the Valley of Ten Thousand Smokes in Alaska and the eruption of Mt. Pelee on the island of Martinique, where 30,000 people were completely annihilated within a few minutes. The Volcanic Tablelands have been faulted and partially eroded since their formation.

West and northwest of the town of Benton is an area of extensive Holocene airfall ash deposits. The volcanic ash is typically rhyolitic, having mineralogy similar to granitic rock. The airfall ash has settled and has become denser since its initial deposition. The present dry bulk density of the ashy soils ranges from 1.1 to 1.3 g/cc. An area of roughly 650 square miles in California and western Nevada was covered with aerial ash deposits of 6 to 36 inches thick. The ash probably originated from the Mono Craters and/or a former volcano in the Long Valley area (which also may have produced the tuffs of the Volcanic Tablelands).

The Benton Range is a complex jumble of granitic, basaltic, and pyroclastic rocks. Isolated islands of soft rhyolitic tuff are also present. Adobe Valley is composed mostly of ashy alluvium, and is rimmed by large Pleistocene rhyolite flows on the southwest side and Pliocene basalt uplands on the north and east. The Cowtrack Mountain - Granite Mountain area is composed mostly of dacite and basalt, as well as granite. The mountains have a blanket of rhyolitic volcanic ash one to three feet thick over the original soils or bedrock.

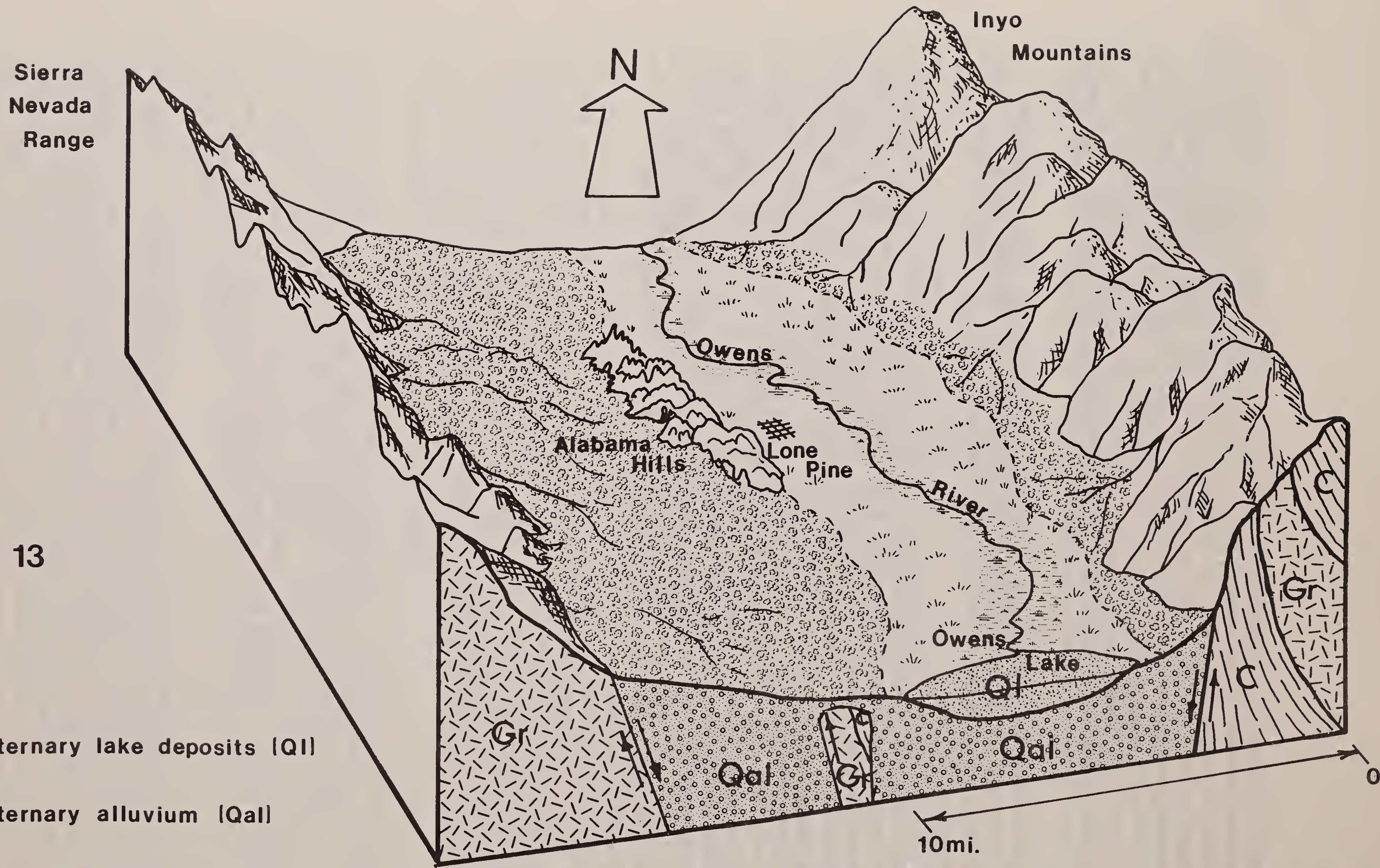
Mono Basin is considered by some geologists to be a structural downwarp or a deep volcano-tectonic depression. Test borings indicate the depth of the sediments in the basin to be about 1,600 feet deep. Ancient Lake Russell apparently filled the entire basin at one time up to an elevation of about 7,200 feet in the Pleistocene epoch. It is thought to have overflowed southeast into Adobe Valley through the route of the present Deep Wells road. Many old shorelines exist, along with numerous outcrops of tufa around the present shoreline. Extensive horizontal beds of soft tufa occur

below the ash mantle in the northeastern part of the basin. Tufa deposits are composed mainly of calcium carbonate precipitated underwater around freshwater springs. Some studies suggest that algae play a dominant role in its formation, while other studies suggest that the precipitation results solely from lowered solubility of calcium carbonate when the cold spring waters suddenly contact the warmer, alkaline lake waters. The present Mono Basin has a thick mantle of rhyolitic volcanic ash. Today, Mono Lake is about twice as saline as sea water. Diatomaceous earth deposits are present on the largely volcanic Paoha and Negit Islands in the middle of the lake.

The Mono Craters are a series of Holocene rhyolitic tuff rings, obsidian plugs, coulees, and explosion cones at the south end of Mono Basin. Panum Crater, within the survey area, is the youngest, with an estimated age of 1,300 years.

The Long Valley area is also thought to have contained a large freshwater lake up to 300 feet deep during the Pleistocene. The valley now is occupied by man-made Crowley Lake. Geophysical studies indicate that Long Valley is a structural graben in which volcanic and alluvial material have accumulated to thicknesses of more than 10,000 feet.[11] Near the surface, a mantle of rhyolitic ash, glacial outwash, and stream alluvium is present. Shallow, horizontal beds of tuffaceous sandstone and conglomerate underlie these deposits in some areas. Long Valley is bounded on all sides by faults that collectively form an oval trace, with Mammoth Mountain at its western edge and Glass Mountain on its eastern edge. This leads some geologists to suspect that this trace may define the caldera of an old volcano whose collapse followed emission of the glowing ash flows of the Volcanic Tablelands.

Figure 13



Quaternary lake deposits (Ql)

Quaternary alluvium (Qal)

Mesozoic granitic rock (Gr)

Paleozoic & Mesozoic metasedimentary and metavolcanic rock (C)

Southern Owens Valley Generalized Geology

Figure 13

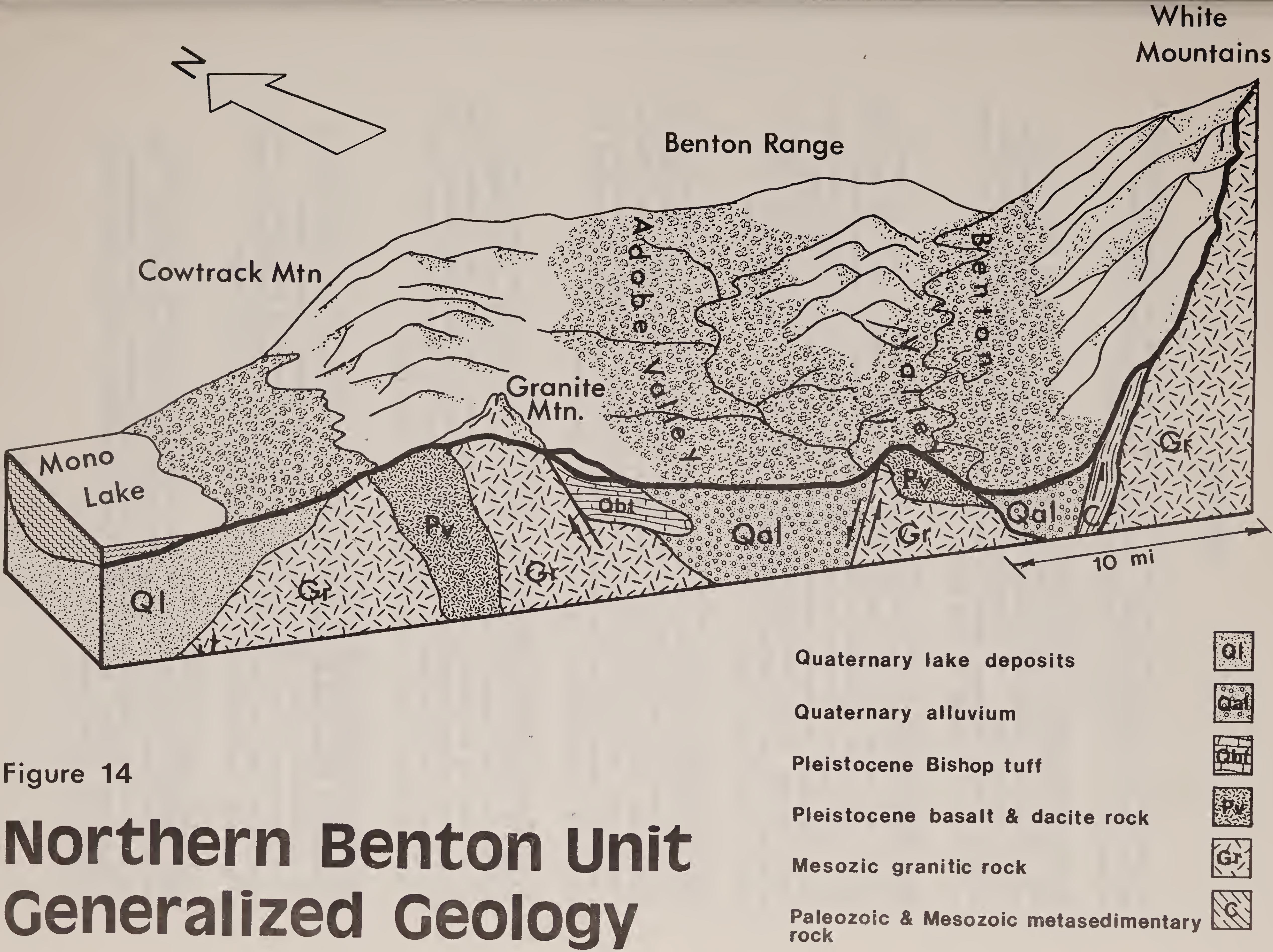


Figure 14

Northern Benton Unit Generalized Geology

Figure 14

VEGETATION

The vegetation of the Benton-Owens Valley area is a mix of Great Basin and Mojave Desert vegetative types. Six major vegetative types have been delineated on the General Vegetation Map (Figure 15).

Mojave Desert Scrub (116,000 acres)
This vegetative type occurs primarily on the eastern floor of Owens Valley and extends partially into the White-Inyo Mountains. Elevations range from 3,600 to 5,500 feet. It is dominated by shadscale, creosotebush, allscale saltbush, white bursage, desert trumpet, and desert needlegrass. Low forage production is typical of this type.

Mixed Desert Scrub (174,000 acres)
This large vegetative type occurs primarily on the western floor of Owens Valley and on the Volcanic Tablelands. Elevations range from 4,000 to 5,500 feet. This type represents a transition zone between the Mojave Desert Scrub and Sagebrush Steppe types. The plant composition is highly variable. Typical plants are Nevada ephedra, Fremont dalea, longspine horsebrush, spiny hopsage, desert needlegrass, Indian ricegrass, blackbrush, California buckwheat, Cooper goldenbush, needleleaf rabbitbrush, bud sagebrush, and Anderson wolfberry. Some of the plants are valuable forage species.

Sagebrush Steppe (175,000 acres)
This vegetative type is the largest in the survey area. It occurs mainly in higher-elevation valleys and on the upper Volcanic Tablelands. Elevations range from 5,100 to 8,800 feet. The major plants are big sagebrush, Douglas rabbitbrush, antelope bitterbrush, desert bitterbrush, Indian ricegrass, needle and thread grass, and green Mormon tea. Most of the forage value in this type is supplied by the grasses and bitterbrushes.

Transmontane Coniferous Vegetation (65,000 acres)
Primarily located in the White-Inyo Mountains and the Benton Range, this vegetative type ranges in elevation from 5,400 to 8,000 feet. The main plants are big sagebrush, singleleaf pinyon pine, Douglas rabbitbrush, green Mormon tea, desert needlegrass, antelope bitterbrush, and Utah juniper. The forage value of this type is similar to that of the Sagebrush Steppe, but steep slopes and lack of water reduces its importance.

Subalpine Woodland (5,000 acres)
This vegetative type occurs primarily on the higher areas of the Inyo Mountains. Elevations range from 8,000 to 11,100 feet. The major plants are singleleaf pinyon pine, curlleaf mountainmahogany, limber pine, bristlecone pine, low sagebrush, junegrass, and Sandberg bluegrass. This vegetative type has low forage production and is further isolated by steep slopes and inaccessibility. It is classed as unsuitable range.

Cool Alkali Sink (17,500 acres)
This vegetative type occurs near wet valley floors in Mono Basin, Adobe Valley, and Long Valley. Elevations range from 6,400 to 7,000 feet. The major plants are inland saltgrass, rubber rabbitbrush, black greasewood, sedges, and rushes. Forage production is variable, but the wetter areas produce excellent forage.

VEGETATION

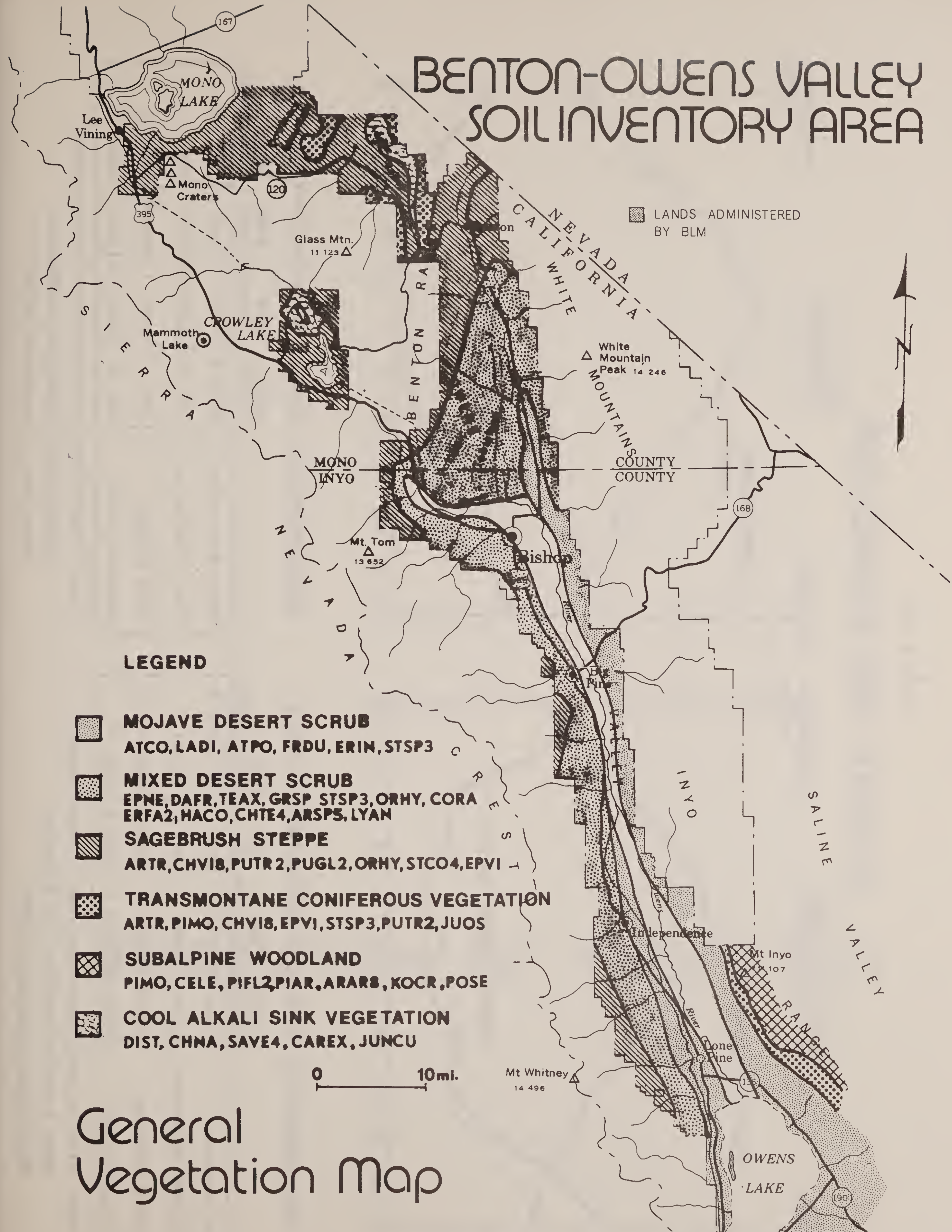
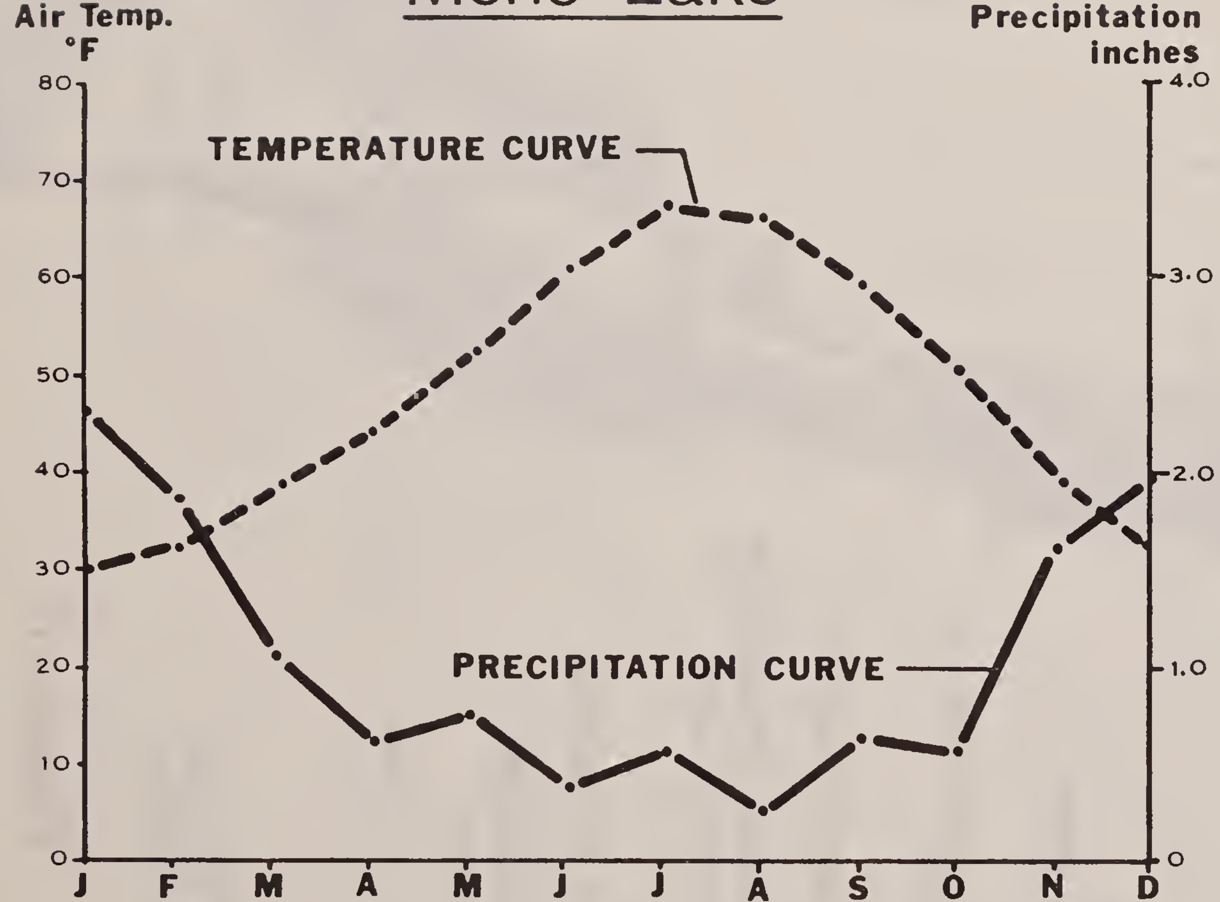

BENTON-OWENS VALLEY
SOIL INVENTORY AREA
LANDS ADMINISTERED BY BLM
MONO LAKE
Lee Vining
Mono Craters
Glass Mtn. 11 123
CROWLEY LAKE
Mammoth Lake
SIERRA NEVADA CREST
BENTON RA
WHITE MOUNTAINS
White Mountain Peak 14 246
NEVADA
CALIFORNIA
MONO
INYO
COUNTY
COUNTY
Mt. Tom 13 652
Bishop
Big Pine
INYO
SALINE VALLEY
Independence
Mt Inyo
RANGE
Lone Pine
Mt Whitney 14 496
OWENS LAKE
Olancha
167
120
395
168
190
LEGEND
MOJAVE DESERT SCRUB
ATCO, LADI, ATPO, FRDU, ERIN, STSP3
MIXED DESERT SCRUB
EPNE, DAFR, TEAX, GRSP STSP3, ORHY, CORA
ERFA2, HACO, CHTE4, ARSP5, LYAN
SAGEBRUSH STEPPE
ARTR, CHVI8, PUTR2, PUGL2, ORHY, STCO4, EPVI
TRANSMONTANE CONIFEROUS VEGETATION
ARTR, PIMO, CHVI8, EPVI, STSP3, PUTR2, JUOS
SUBALPINE WOODLAND
PIMO, CELE, PIFL2, PIAR, ARAR8, KOCR, POSE
COOL ALKALI SINK VEGETATION
DIST, CHNA, SAVE4, CAREX, JUNCU
0
10mi.
General Vegetation Map

Figure 15

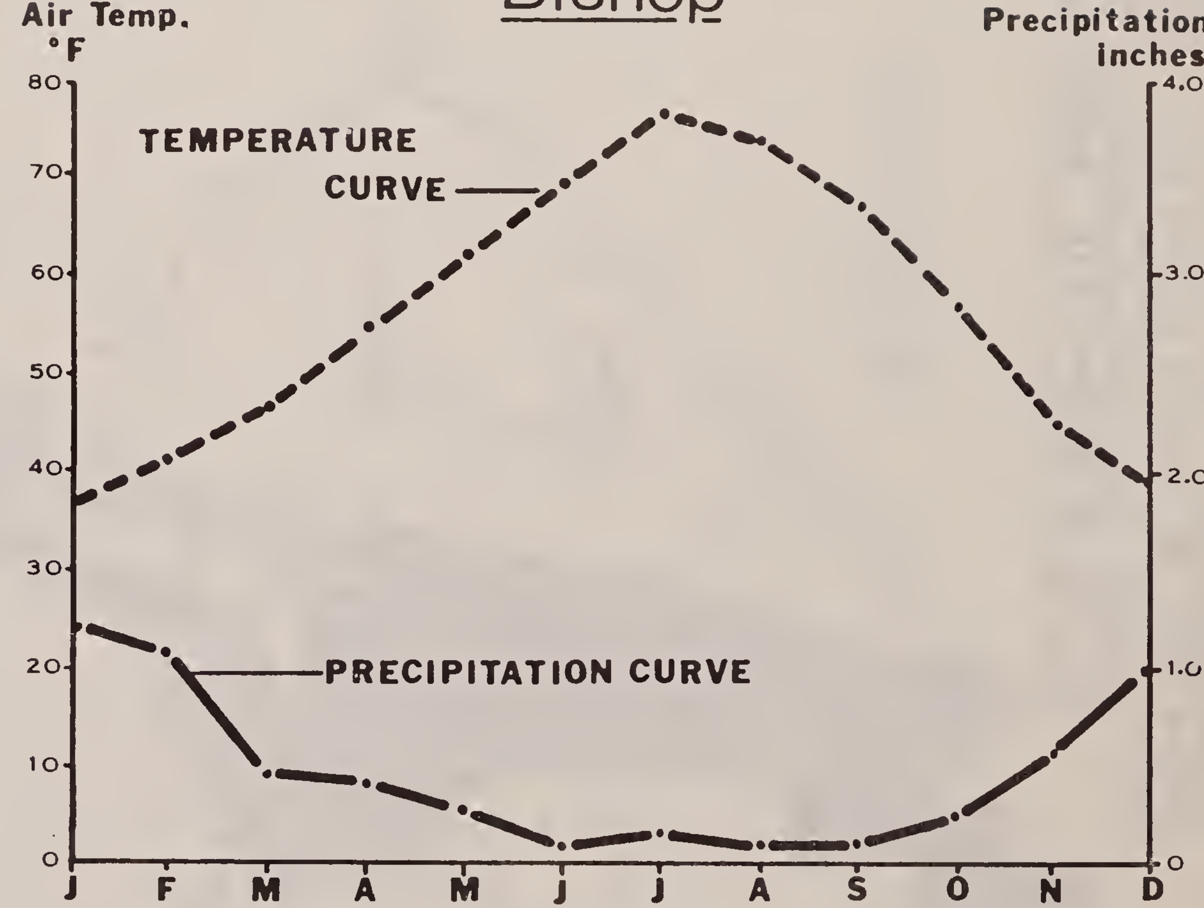
Figure 16

CLIMATE AND PHENOLOGY

Mono Lake



Bishop



DEVELOPMENTAL STAGES OF IMPORTANT PLANTS

	Begin Growth	Peak Flowering	Seed Ripe	Seed Dissemination
Big Sagebrush	June 15	Sept. 1	Nov. 1	December 1
Antelope Bitterbrush	April 1	May 15	July 1	August 1
Indian Ricegrass	March 1	June 1	July 15	August 15
Perennial Forbs	April 15	June 1	Aug. 1	Sept. 1

Note: Climatic data is averaged over a 19 year period.
Mean Annual Precipitation - 12.53 inches
Mean Annual Temperature-47.5°F

DEVELOPMENTAL STAGES OF IMPORTANT PLANTS

	Begin Growth	Peak Flowering	Seed Ripe	Seed Dissemination
Desert Bitterbrush	March 1	May 1	June 15	July 15
Desert Needlegrass	Feb. 15	April 15	June 1	July 1
Spiny Hopsage	Feb. 1	April 1	May 15	June 15
Perennial Forbs	Feb 5	April 15	June 1	July 1

Note: Climatic data is averaged over a 34 year period.
Mean Annual Precipitation - 5.72 inches
Mean Annual Temperature - 55.9°F

FORMATION OF THE SOILS

FORMATION OF THE SOILS

In this section the factors that affect the formation of the soils in the Benton-Owens Valley Area are discussed, and important processes in the morphology of the soils are described.

Factors of Soil Formation

Soil is a natural substance on the surface of the earth in which plants grow. It is composed of mineral and organic material. Soils differ in their appearance, composition, management requirements, and productivity in different localities or even within short distances in the same locality. The factors that cause soil to differ are: (1) the physical and chemical composition of the parent material, (2) the climate or climates under which the soil material has accumulated and existed since accumulation; (3) the relief or lay of the land, and drainage; (4) the biological activity, including plant and animal life in and on the soil; and (5) the length of time these forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another. Also, these factors are somewhat interrelated; for example, certain climates cause pinyon pines to grow, which causes the soil to be more acid under the tree canopies. In the Benton-Owens Valley Area, the most important factors are parent material, climate, and time.

Parent Material

Parent material is the weathered rock or alluvium from which soils form. A wide variety of parent materials is present in the area. Following is a discussion of each type.

Granitic alluvium - the predominant parent material on the alluvial fans at the base of the Sierra Nevada and northern White Mountains. This material consists of sand, loamy sand, or sandy loam with varying amounts of rock fragments. Most of the soils formed in this material contain cobbles, stones, and boulders which strikingly affect their appearance and management. Some boulders as large as 20 feet in diameter are present. This material is poorly sorted and is considered to be geologically recent. It was deposited by violent flash floods or mudflows emerging from the canyon mouths. In the Sierra Nevada canyons, much of the material may have existed as morainal deposits prior to its re-deposition on the alluvial fans. Most of this material is noncalcareous, although in the drier areas around Owens Lake, the Alabama Hills, and on the east side of Owens Valley, it is calcareous. This is probably due to calcareous dust that is deposited on the soil surface and then leached into the soil by rainwater, or by the presence of some calcareous sedimentary rock alluvium. Soils formed in granitic alluvium are the Arizo, Bitter, Cajon, Garlock Variant, Lubkin, Pajuela, Rovana, Tinemaha, Thibau, Tuttle, Washoe, Washoe Variant, and Yellowrock soils.

Sedimentary and mixed alluvium - the predominant parent materials on the alluvial fans at the base of the Inyo Mountains and Southern White Mountains, and on the floor of Owens Valley. It consists of calcareous

loamy or sandy material with varying amounts of angular gravel, cobbles, and a few stones. It is poorly sorted and considered to be geologically recent. The gravel and cobbles affect the management and uses of soils formed in this material. It was deposited by violent flash floods or mud flows emerging from the canyon mouths. The floodplain sediments of the valley floors generally lack rock fragments because they were deposited by much calmer waters. Soils formed on this material are the Halloran Variant, Hoye Variant, Millner, Dotard, Tuttle Variant, Victorville family, Villa family, Yellowrock, Yermo, and Seaman soils.

Ashy alluvium and aeolian material - the predominant parent materials in the valleys west of Benton and in small valleys on the Volcanic Tablelands. It is sandy, noncalcareous, rhyolitic volcanic ash that has been retransported by water and wind since its aerial deposition. This material is geologically recent and produces soils with high infiltration rates, loose consistence, and low bulk density. It is high in weatherable silica, so that soils formed on it show a pronounced tendency to form duripans. This is the case with the Sawavu series. The hills of the northern Benton unit has received a blanket of ash that varies from one to about three feet thick. Its high permeability greatly reduces surface. This material is low in mineral nutrients because of its high silica content. Soils formed on this material are the Alamedawell, Brantel, Brantel Variant, Cowtrack, Cowtrack Variant, Deepwell, Hammil, Sawavu, and Zono soils.

Volcanic tuffs, basalts, and basaltic lava - have produced some unique soils. Both hard and soft rhyolitic tuffs are present on the Volcanic Tablelands and in the Benton Range. Soils formed on soft tuff closely resemble those formed on ashy alluvium. The hard tuffs produce shallow, loamy or sandy soil with many tuff fragments present. Rhyolitic tuff is high in silica and low in mineral nutrients. Basaltic lava is the parent material on lava flows in Owens Valley. The soils formed on it are very deep, but contain many jagged, low density lava cinders (gravel, cobble, and stone-sized) and frequent rock outcrops are present. This gives the area a "moonscape" appearance. This material is higher in mineral nutrients than the rhyolitic tuffs and ash. Basalt of the mountainous uplands around Adobe Valley has produced soils similar to those on lava flows, but with denser, more angular rock fragments and hard bedrock below. Soils formed on these materials are Buscones and Chidago (soft tuff), Cashbaugh taxadjunct, Honova, and Sherwin (hard tuff), Pizona (basalt), and Avalmount, Taboose, and Taboose taxadjunct (basaltic lava).

Granitic residuum - the predominant parent material of the Sierra Nevada and parts of the Cowtrack and White-Inyo Mountains. It has produced soils with loamy sand or sandy loam textures which contain many coarse sands and much unweathered quartz. In many areas the soils are stony and bouldery due to the widely spaced fracture planes of the rock. Soils formed on this material are the Berent family, Glenbrook family, Haar family, Honova Variant, Toquerville family, Whitewolf family, and some soils in the Inyo Mountains mapped at higher categories.

Metasedimentary and metavolcanic residuum - the predominant parent materials of the White-Inyo Mountains, Benton Range, Poverty Hills, and parts of Cowtrack Mountain. Soils formed on these parent materials tend to be shallow, loamy soils with much angular gravel and cobbles. Most of them

are calcareous due to the presence of lime ($CaCO_3$) in the parent rock. These materials are higher in weatherable minerals and produce more silicate clays than the tuffs, ash, or granitic rocks. Some of the most developed argillic horizons in the survey area are in soils formed on these parent materials. Typical rock types include shales, phyllites, limestones, slates, dolomites, sandstones, and metamorphosed rhyolitic or basaltic tuffs. Soils formed on this material include most the the Lithic Torriorthents, Lithic Haplargids, Lithic Xerollic Haplargids, Lithic Xeric Torriorthents and Cryoborolls of the aforementioned areas.

Climate

Climate has a marked influence on soil formation in the area. Precipitation and temperature strongly influence the kind and amount of vegetation that grows, the rate of organic matter accumulation in the soil, the rate at which minerals weather, and the rate at which weathered material moves from one soil horizon and accumulates in another.

The present arid or semiarid climate of the area generally reduces the rates mentioned above. The production of organic material is quite low because of this climate. Some soils with fairly dark surfaces are present at the base of the Sierra Nevada (Washoe and Washoe Variant soils) where the mean annual precipitation is about 10 inches. These soils have been in their present position for a relatively moderate length of time and have accumulated moderate amounts of organic matter. Dark (mollic) surfaces may eventually develop in time on these soils and on most of the soils that receive more than 10 inches of precipitation.

Precipitation in the area is sufficient to wet the soils to a depth of one to eight feet. In areas with less than eight inches of precipitation (much of Owens Valley and the Inyo Mountains) some of the lime is leached to a depth of about six inches if it is present in the parent material. However, these soils still contain free lime ($CaCO_3$) throughout the profile. In Owens Valley, the precipitation has been high enough to leach the surface of soluble sodium salts to a depth of 2 or 3 feet, provided there is no high water table. Summer thunderstorms may cause the vesicular layers that are present just beneath the surface of some of the soils. Rapid wetting of the warm surface soils with rainwater may cause air bubbles in the soil and form vesicles that persist after drying. Heat liberation upon wetting the surface soil may also play an important role. These thunderstorms may also be important in the formation of surface pavements on gravelly soils. Raindrop splash removes small quantities of fines from the surface crust, exposing more rock fragments. More importantly, rapid wetting of previously dry surface soils causes upward migration of rock fragments.[12] In time, most of the rock fragments in the surface four inches will migrate to the surface by this process, forming a surface pavement or "desert pavement". There is very little natural erosion in the inventory area because of low precipitation and sandy soil surfaces, or well developed surface pavements. Soils are stable and some have existed long enough in the steep Inyo Mountains to develop clay films and argillic horizons.

Temperature in the area tends to decrease with increasing precipitation and thus partially offset any increase in chemical weathering rates that might accompany the increased precipitation at the higher elevations. Soil

minerals weather fastest under warm and moist conditions (which do not exist in this inventory area). The climate has tended to produce a weathering regime that yields clay minerals of the montmorillonite, illite, and chlorite groups.

Dust storms in Owens Valley continually add minute quantities of calcareous dust on the valley soils, keeping the soil reaction above pH 7. They may also be partially responsible for the initial development of erosion pavements present on the soils of the east side of Owens Valley - winds may remove small quantities of the fine material. Winds in the northern part of the area have reworked much of the volcanic ash that is present. Stabilized sand dunes occur in Adobe Valley and Mono Basin.

The past climate of the area manifests itself in some of the older soils in the area. The Pleistocene epoch is thought to have been considerably wetter than the present climate. Some of the older soils in the area are on dissected remnants of alluvial fans and show pronounced silica and clay translocation through the profile, as evidenced by their duripans and clayey argillic horizons.

Time

The age of the soils in the inventory area varies from extremely recent to very old. However, most of the soils are developing in recent alluvium or recent airfall ash deposits. The period of time that the other four factors have been working has not been long enough to produce distinct horizons. Typical of these young soils are the Brantel soils formed in deep ash, the Thibau soils formed in sandy granitic alluvium, and the Berent family soils formed in sandy granitic colluvium.

The oldest soils in the area are on stable remnants of old alluvial fans from the Sierra Nevada, Inyo Mountains, Benton Range, and in the Inyo Mountains themselves. These remnant fans are slightly to moderately dissected, but have not been covered by more recent flows since their initial deposition. Some rare, old Abruptic Xerollic Durargids occur between Bishop and Big Pine, on the west side of Owens Valley. These soils resemble some of the old river terrace soils in the San Joaquin and Sacramento Valley which have reddish, iron-silica-cemented duripans. Dissected fan remnants at the base of the Inyo Mountains have gravelly soils with duripans, but no argillic horizons. This may be due to the presence of carbonates inhibiting clay translocation in the soil profile. The old soils in the Inyo Mountains are on stable hillsides and gently sloping benches. Well developed argillic horizons are present, but no duripans.

The alluvial fan apron at the base of the Sierra Nevada is a good example of the time factor in soil formation. On some fans the soils are predominantly Haplargids (Tinemaha, Lubkin, or Washoe series), and on adjacent fans the soils are younger and show little or no horizon development (Pajuela, Thibau, Arizo, Tuttle, or Rovana series . . . all Torriorthents). We can interpret this by saying that the older fans have not experienced a large flash flood in several thousand years.

The desert pavements which cover most of the soils in the Inyo Mountains and their associated alluvial fans are thought to require two to five thousand

years for formation.

Relief

The relief of the inventory area is quite varied, but has had a minor influence on soil formation due to the semiarid climate, lack of erosion, and rapid infiltration rates on many soils.

Low areas in Owens Valley and Adobe Valley have produced soils with saline-sodic conditions and/or high water tables, such as the Victorville and Villa family soils.

Long expanses of nearly level terrain in Mono Basin, Adobe Valley, and southern Owens Valley have allowed winds to transport sands into dune-like or undulating topography in some of these areas.

Biological Activity

Biological activity in the inventory area has had a minor influence on soil formation. This is mainly due to the semiarid climate, low production of organic matter, and young age of the soils. The average annual production of air dry vegetation averages only 200 to 700 pounds per acre, mostly as perennial shrubs. Grasses tend to contribute more organic matter to the soil than shrubs, but the sandy surface textures of most of the soils in the area do not favor grass production. This is especially true of the ashy soils in the Benton unit.

Big sagebrush vegetation can produce soils with dark-colored surface layers, but this process usually takes several thousand years. Many of the ashy soils in the northern Benton unit, such as Brantel, Cowtrack, and Zono, may eventually develop dark-colored (mollic) surface layers in areas where the mean annual precipitation is more than 10 inches.

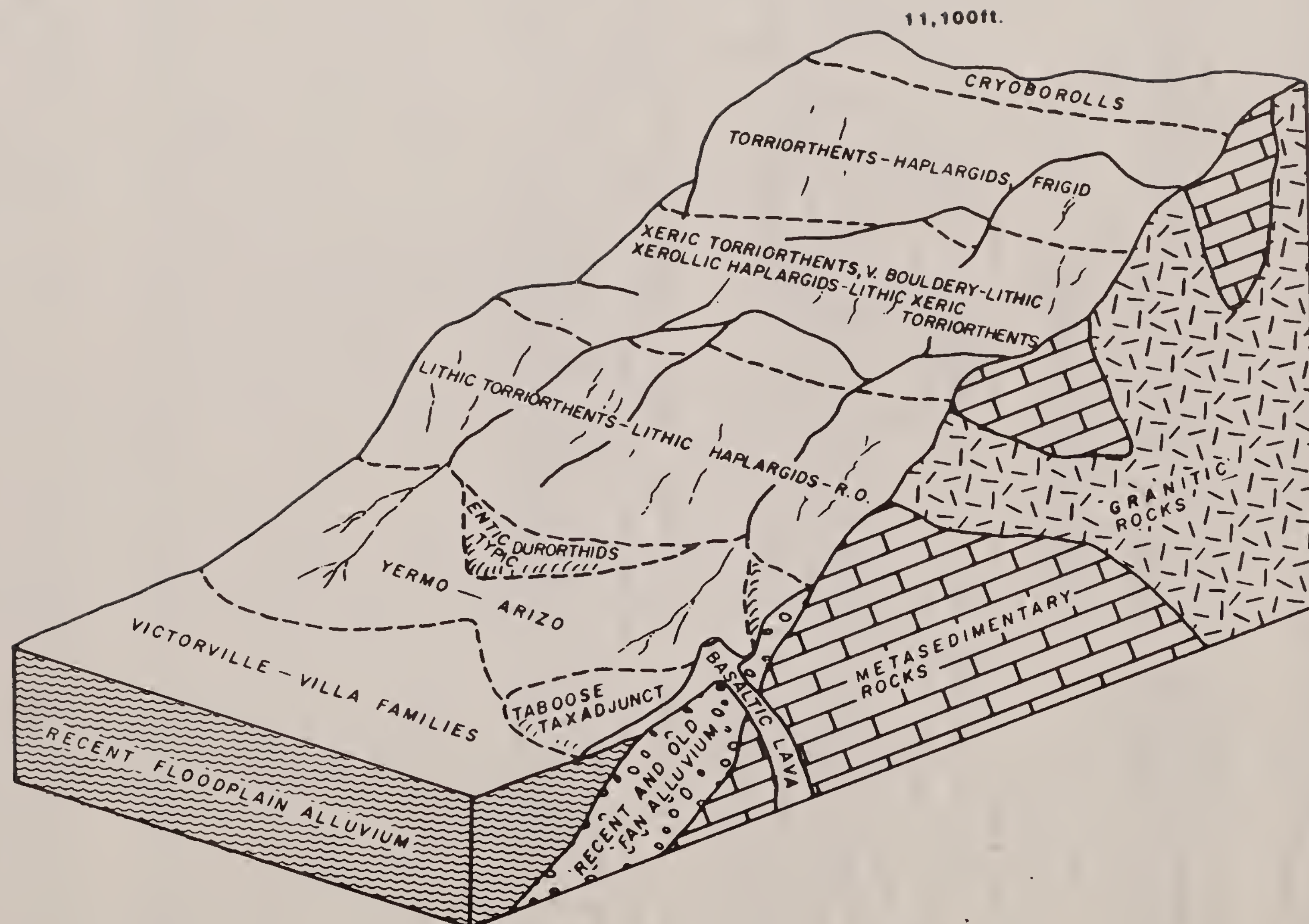


Figure 17.- Typical pattern of soils on the eastern side of Owens Valley and in the Inyo Mountains.

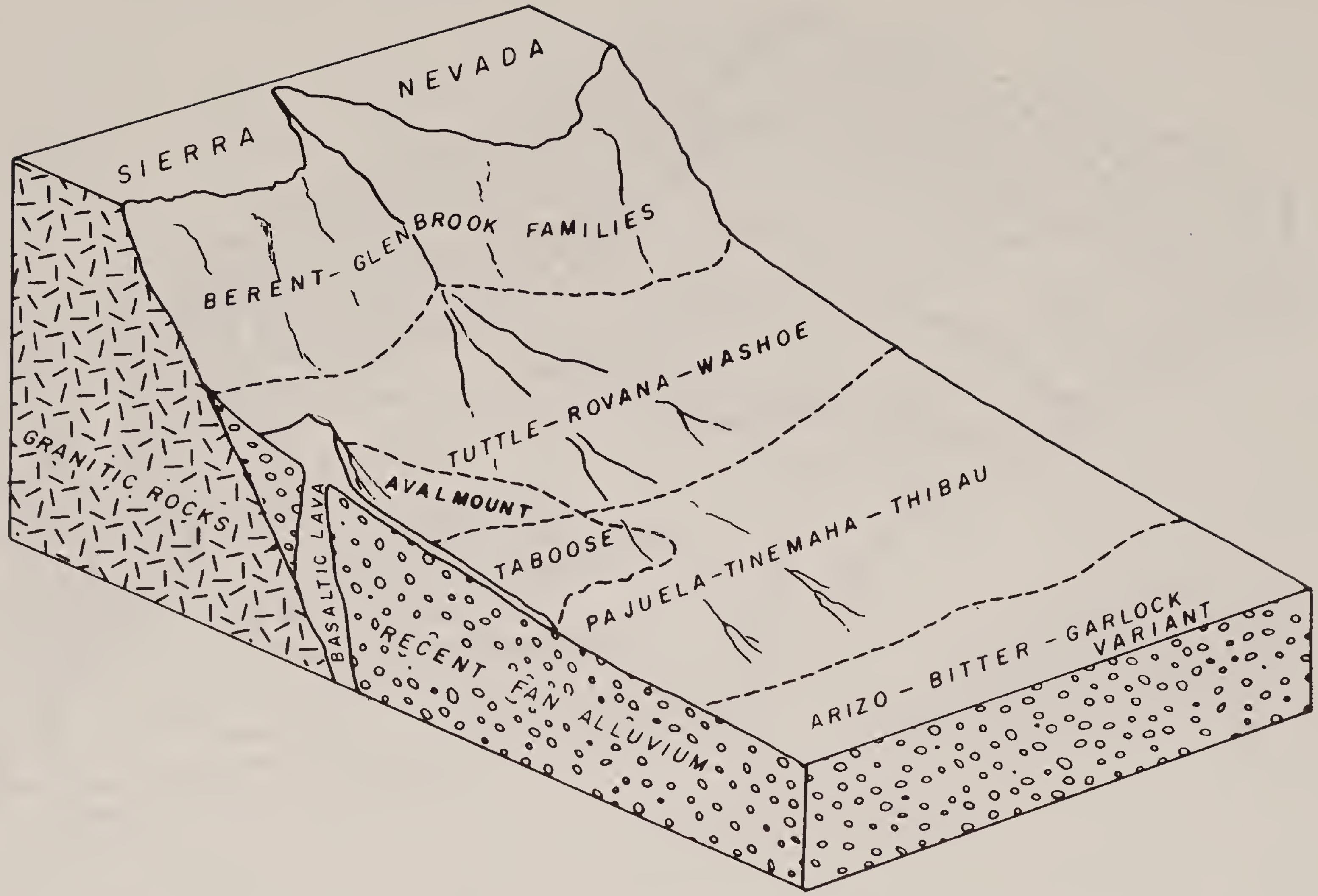


Figure 18.- Typical pattern of soils on the western side of Owens Valley and on the Sierra Nevada escarpment.

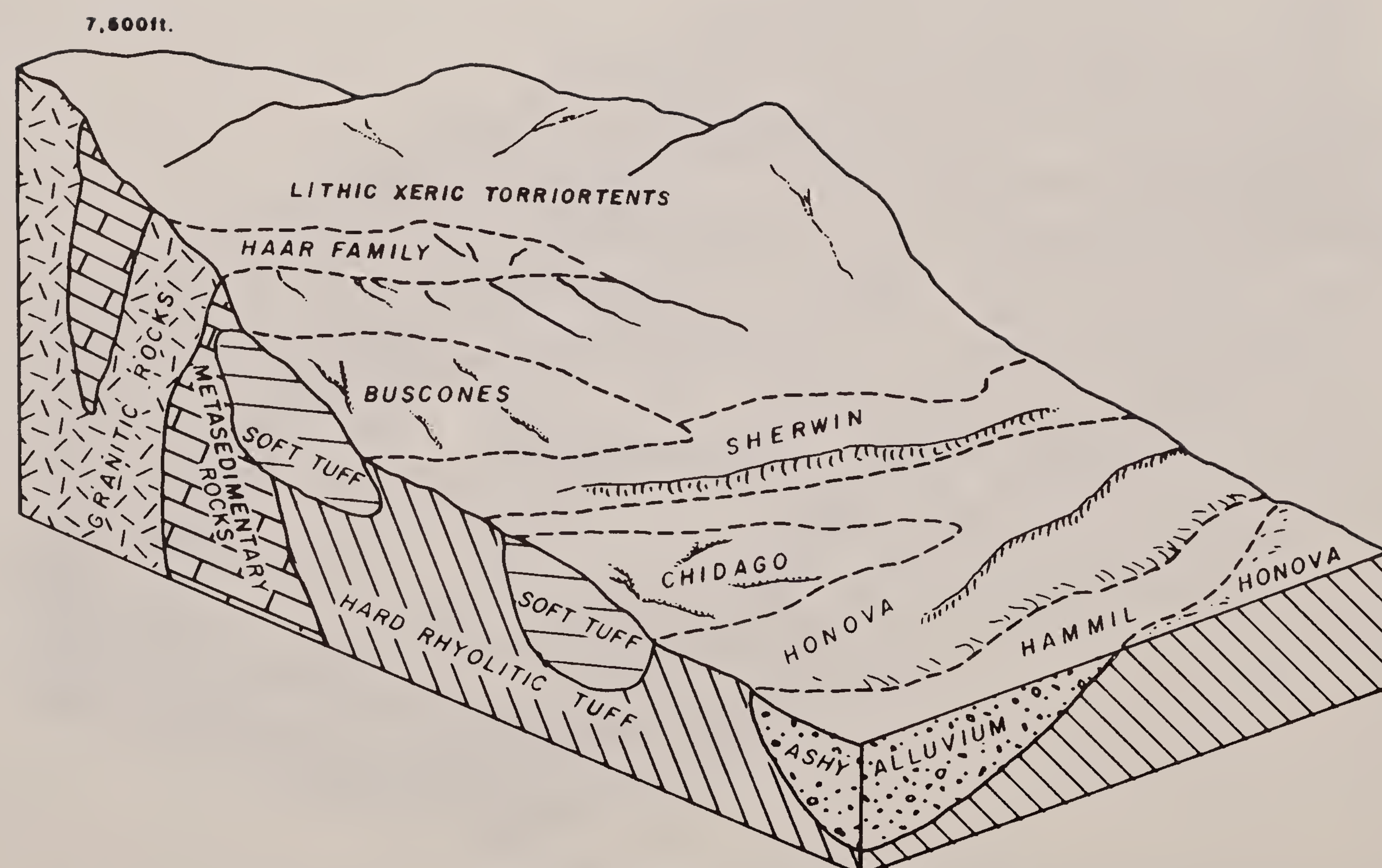


Figure 19.- Typical pattern of soils on the Volcanic Tablelands and in the Benton Range.

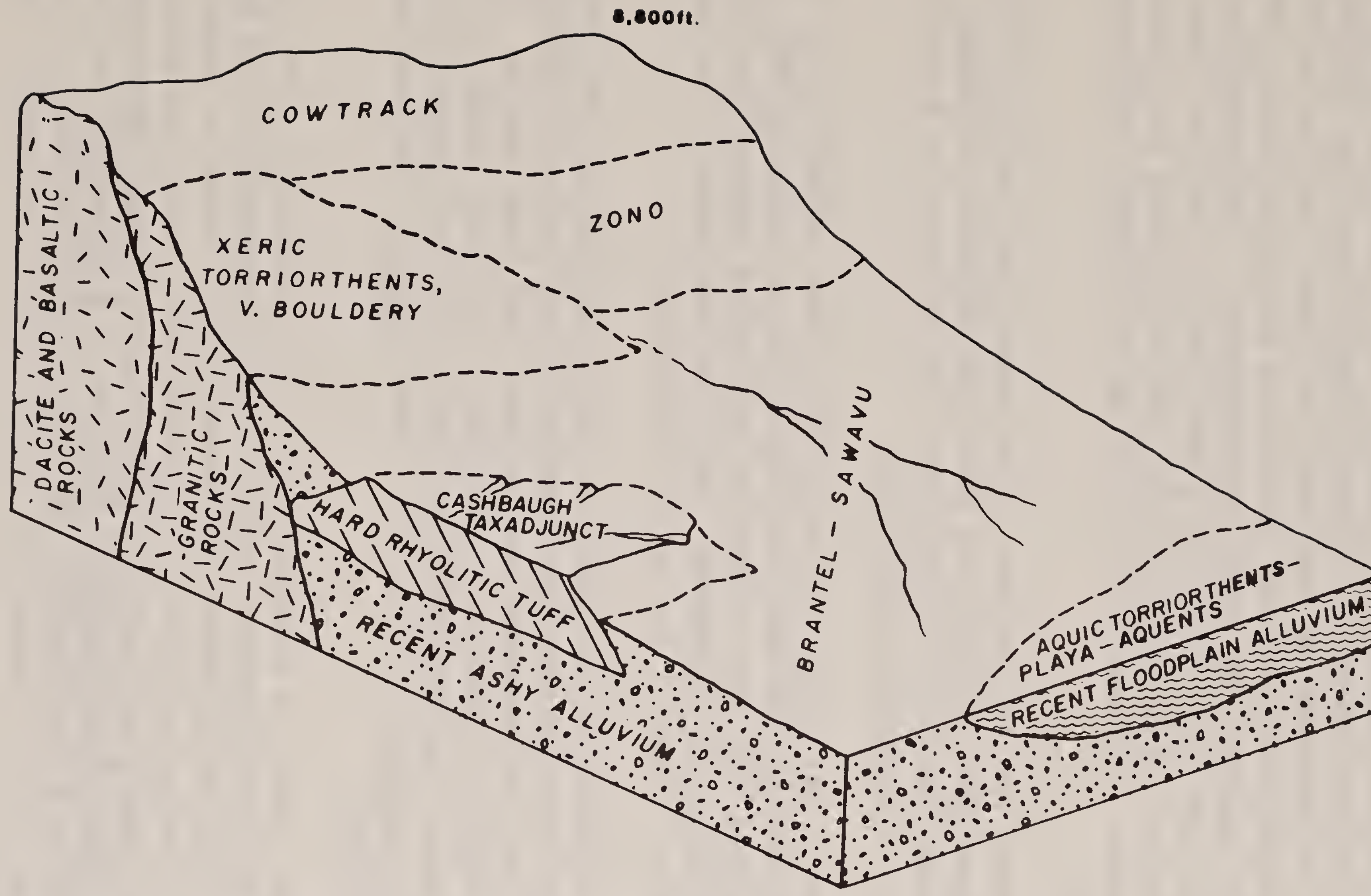


Figure 20.- Typical pattern of soils in the Adobe Valley- Cowtrack Mtn. area.

SOIL CLASSIFICATION

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (5).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties for the higher categories are the result of soil genesis or of factors that affect soil genesis. In Table R, the soils of the inventory area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in <u>sol</u>. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthent (Orth, meaning common, plus <u>ent</u>, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Torriorthents (<u>Torri</u>, meaning hot and dry, plus <u>orthent</u>, the suborder of Entisols that are common).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective <u>Typic</u> is used for the subgroup that is thought to typify the great group. An example is Typic Torriorthents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistency, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil

SOIL CLASSIFICATION

properties used as family differentiae. An example is sandy-skeletal, mixed, thermic, Typic Torriorthents.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistency, and mineralogical and chemical composition. An example is the Arizo series, a member of the sandy-skeletal, mixed, thermic Typic Torriorthents.

TABLE R

CLASSIFICATION OF THE SOILS

SOIL	CLASSIFICATION	ACRES
Alamedawell[4]	Ashy over loamy, mixed (calcareous), mesic Xeric Torriorthents	960
Aquents		2,140
Aquic Torriorthents		5,310
Arizo	Sandy-skeletal, mixed, thermic Typic Torriorthents	5,000
Avalmount[4]	Cindery, mesic Xerollic Camborthids	1,790
Berent family	Mixed, mesic Xeric Torripsamments	1,840
Bitter	Loamy-skeletal, mixed, thermic Typic Haplargids	2,910
Brantel[4]	Ashy, mesic Xeric Torripsamments	46,490
Brantel Variant	Cindery, mesic Xeric Torriorthents	1,460
Buscones[1,4]	Ashy, mesic Xeric Torripsamments	10,420
Cajon	Mixed, thermic Typic Torripsamments	4,210
Cashbaugh[2,4]	Mixed, mesic Lithic Torripsamments	3,480
Chidago[4]	Ashy, thermic Xeric Torripsamments	16,720
Cowtrack[4]	Ashy over loamy, mixed, nonacid, frigid Xeric Torriorthents	8,310
Cowtrack Variant	Ashy, frigid Xeric Torripsamments	1,260
Cryoborolls		2,160
Deepwell[4]	Ashy, mesic Xeric Torripsamments	1,420
Dotard*	Loamy-skeletal, mixed (calcareous), mesic Xeric Torriorthents	1,410
Durargids, shallow		1,110
Durorthids, ashy		250
Entic Durorthids		8,290
Garlock Variant	Fine-loamy, mixed, thermic Typic Haplargids	1,460
Glenbrook family	Mixed, mesic, shallow Xeric Torripsamments	1,110
Haar family	Loamy, mixed, nonacid, mesic, shallow Xeric Torriorthents	2,980
Halloran Variant	Coarse-loamy, mixed, thermic Typic Natrargids	390
Hammil[4]	Ashy, thermic Xeric Torripsamments	9,020
Haplargids, frigid		1,970
Honova[4]	Loamy, mixed, nonacid, thermic Lithic Xeric Torriorthents	39,870
Honova Variant	Mixed, thermic, shallow Xeric Torripsamments	1,425
Hoye Variant	Fine-loamy, mixed, mesic Xeralfic Haplargids	810
Lithic Haplargids		9,430
Lithic Torriorthents		18,850
Lithic Xeric Torriorthents		12,380
Lithic Xerollic Haplargids		9,310
Lubkin[4]	Coarse-loamy, mixed, thermic Xeralfic Haplargids	3,340

properties used as family differentiae. An example is sandy-skeletal, mixed, thermic, Typic Torriorthents.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistency, and mineralogical and chemical composition. An example is the Arizo series, a member of the sandy-skeletal, mixed, thermic Typic Torriorthents.

TABLE R

CLASSIFICATION OF THE SOILS

SOIL	CLASSIFICATION	ACRES
Alamedawell[4]	Ashy over loamy, mixed (calcareous), mesic Xeric Torriorthents	960
Aquents		2,140
Aquic Torriorthents		5,310
Arizo	Sandy-skeletal, mixed, thermic Typic Torriorthents	5,000
Avalmount[4]	Cindery, mesic Xerollic Camborthids	1,790
Berent family	Mixed, mesic Xeric Torripsamments	1,840
Bitter	Loamy-skeletal, mixed, thermic Typic Haplargids	2,910
Brantel[4]	Ashy, mesic Xeric Torripsamments	46,490
Brantel Variant	Cindery, mesic Xeric Torriorthents	1,460
Buscones[1,4]	Ashy, mesic Xeric Torripsamments	10,420
Cajon	Mixed, thermic Typic Torripsamments	4,210
Cashbaugh[2,4]	Mixed, mesic Lithic Torripsamments	3,480
Chidago[4]	Ashy, thermic Xeric Torripsamments	16,720
Cowtrack[4]	Ashy over loamy, mixed, nonacid, frigid Xeric Torriorthents	8,310
Cowtrack Variant	Ashy, frigid Xeric Torripsamments	1,260
Cryoborolls		2,160
Deepwell[4]	Ashy, mesic Xeric Torripsamments	1,420
Dotard*	Loamy-skeletal, mixed (calcareous), mesic Xeric Torriorthents	1,410
Durargids, shallow		1,110
Durorthids, ashy		250
Entic Durorthids		8,290
Garlock Variant	Fine-loamy, mixed, thermic Typic Haplargids	1,460
Glenbrook family	Mixed, mesic, shallow Xeric Torripsamments	1,110
Haar family	Loamy, mixed, nonacid, mesic, shallow Xeric Torriorthents	2,980
Halloran Variant	Coarse-loamy, mixed, thermic Typic Natrargids	390
Hammil[4]	Ashy, thermic Xeric Torripsamments	9,020
Haplargids, frigid		1,970
Honova[4]	Loamy, mixed, nonacid, thermic Lithic Xeric Torriorthents	39,870
Honova Variant	Mixed, thermic, shallow Xeric Torripsamments	1,425
Hoye Variant	Fine-loamy, mixed, mesic Xeralfic Haplargids	810
Lithic Haplargids		9,430
Lithic Torriorthents		18,850
Lithic Xeric Torriorthents		12,380
Lithic Xerollic Haplargids		9,310
Lubkin[4]	Coarse-loamy, mixed, thermic Xeralfic Haplargids	3,340

SOIL	CLASSIFICATION	ACRES
Millner[4]	Loamy-skeletal, mixed (calcareous), thermic Xeric Torriorthents	11,100
Pajuela	Sandy-skeletal, mixed, thermic Xeric Torriorthents	16,800
Pizona[4]	Loamy-skeletal, mixed, mesic Xeralfic Haplargids	9,310
Rovana[4]	Sandy, mixed, mesic Xeric Torriorthents	7,420
Sawavu[4]	Ashy, mesic Haploxerollic Durorthids	7,920
Seaman	Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents	1,110
Sherwin[4]	Loamy, mixed, nonacid, mesic Lithic Xeric Torriorthents	4,340
Taboose[3,4]	Cindery, thermic Xeric Torriorthents	9,310
Thibau[4]	Sandy, mixed, thermic Xeric Torriorthents	4,440
Tinemaha[4]	Loamy-skeletal, mixed, thermic Xeralfic Haplargids	9,770
Toquerville family	Mixed, thermic Lithic Torripsamments	1,420
Torriorthents, frigid		2,270
Torripsamments		680
Tuttle[4]	Sandy-skeletal, mixed, mesic Xeric Torriorthents	13,320
Tuttle Variant	Loamy-skeletal, mixed, nonacid, mesic Xeric Torriorthents	1,270
Typic Durorthids		2,760
Victorville family	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents	2,650
Villa family	Sandy, mixed, thermic Typic Torrifluvents	2,060
Washoe*	Loamy-skeletal, mixed, mesic Xerollic Haplargids	4,580
Washoe Variant	Fine-loamy, mixed, mesic Xerollic Haplargids	1,100
Wellington*	Loamy, mixed, mesic, shallow Xerollic Durargids	3,850
Whitewolf family	Mixed, thermic Xeric Torripsamments	4,260
Xeralfic Haplargids, mesic		1,340
Xeric Torriorthents		1,460
Xeric Torriorthents, ashy		750
Xeric Torriorthents, sodic		940
Xeric Torriorthents, very bouldery		9,240
Xerollic Durorthids		1,610
Yellowrock	Sandy, mixed, thermic Typic Torriorthents	4,740
Yermo	Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents	16,710
Zono[4]	Ashy over loamy, mixed, nonacid, mesic Xeric Torriorthents	11,500

* Taxadjunct to the series
1 Buscones soils in unit 116 are taxadjunct to the Buscones series.
2 Cashbaugh soils in unit 117 are taxadjunct to the Cashbaugh series.
3 Taboose soils in unit 150 are taxadjunct to the Taboose series.
4 New series established during this inventory.

TAXONOMIC KEY TO THE SOILS

ARIDISOLS

Argids
Durargids
Xerollic Durargids
loamy, mixed, mesic, shallow
Wellington

Natrargids
Typic Natrargids
coarse-loamy, mixed, thermic
Halloran Variant

Haplargids
Typic Haplargids
loamy-skeletal, mixed, thermic
Bitter
fine-loamy, mixed, thermic
Garlock Variant

Xeralfic Haplargids
fine-loamy, mixed, mesic
Hoye Variant
loamy-skeletal, mixed, mesic
Pizona*
loamy-skeletal, mixed, thermic
Tinemaha*
coarse-loamy, mixed, thermic
Lubkin*

Xerollic Haplargids
loamy-skeletal, mixed, mesic
Washoe
fine-loamy, mixed, mesic
Washoe Variant

Orthids
Camborthids
Xerollic Camborthids
cindery, mesic
Avalmount*
Durorthids
Haploxerollic Durorthids
ashy, mesic
Sawavu*

ENTISOLS

Fluvents
  Torrifluvents
    Typic Torrifluvents
      sandy, mixed, thermic
        Villa family
      coarse-loamy, mixed (calcareous), thermic
        Victorville family

Orthents
  Torriorthents
    Typic Torriorthents
      cindery, thermic
        Taboose
      sandy-skeletal, mixed, thermic
        Arizo
      loamy-skeletal, mixed (calcareous), thermic
        Yermo
      sandy, mixed, thermic
        Yellowrock
      coarse-loamy, mixed (calcareous), thermic
        Seaman

    Lithic Xeric Torriorthents
      loamy, mixed, nonacid, mesic
        Sherwin*
      loamy, mixed, nonacid, thermic
        Honova*

    Xeric Torriorthents
      cindery, mesic
        Brantel Variant
      cindery, thermic
        Taboose*
      ashy over loamy, mixed, nonacid, frigid
        Cowtrack*
      ashy over loamy, mixed (calcareous), mesic
        Alamedawell*
      ashy over loamy, mixed, nonacid, mesic
        Zono*
      sandy-skeletal, mixed, mesic
        Tuttle*
      sandy-skeletal, mixed, thermic
        Pajuela
      loamy-skeletal, mixed, nonacid, mesic
        Tuttle Variant
      loamy-skeletal, mixed (calcareous), mesic
        Dotard

loamy-skeletal, mixed (calcareous), thermic
Millner*
sandy, mixed, mesic
Rovana*
sandy, mixed, thermic
Thibau*
loamy, mixed, nonacid, mesic, shallow
Haar family

Psamments
Torripsamments
Typic Torripsamments
mixed, thermic
Cajon

Lithic Torripsamments
ashy, mesic
Cashbaugh[1]
mixed, mesic
Cashbaugh*
mixed, thermic
Toquerville family

Xeric Torripsamments
ashy, frigid
Cowtrack Variant
ashy, mesic
Brantel*
Buscones*
Deepwell*
ashy, thermic
Chidago*
Hammil*
mixed, mesic
Berent family
Buscones[1]
mixed, mesic, shallow
Glenbrook family
mixed, thermic
Whitewolf family
mixed, thermic, shallow
Honova Variant

1 Taxadjunct to the series
* new series

SOIL
TECHNICAL DESCRIPTIONS

SOIL TECHNICAL DESCRIPTIONS

On the following pages, soils in the inventory area are described in detail. The descriptions are presented in alphabetical order.

For each soil, some facts about the soil and its parent material are presented first. Then a pedon, a small three dimensional area of soil typical of the soil in the area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual[13]. Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil as it was mapped in this inventory area. Phases, or mapping units, of each soil are described in the section "Soil Mapping Unit Descriptions".

ALAMEDAWELL SERIES

The Alamedawell series consists of very deep, somewhat excessively drained soils. They formed in ashy alluvium or aeolian deposits underlain by old lake sediments. Alamedawell soils are on hummocky lake terraces and have slopes of 2 to 9 percent. The mean annual precipitation is 8 to 10 inches, and the mean annual temperature is 45 to 50°F.

Taxonomic Class: Ashy over loamy, mixed (calcareous), mesic Xeric Torriorthents

Typical Pedon: Alamedawell loamy sand on a 3 percent northeast facing slope at 6,660 feet elevation under big sage, little horsebrush, and black greasewood vegetation. Colors are for dry soil unless otherwise stated. When described (6/30/80) the soil was dry throughout.

The soil surface is covered with 5 percent fine pumice gravel.

A--0 to 3 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 5 percent fine pumice pebbles; moderately alkaline (pH 8.2); clear smooth boundary. (2 to 3 inches thick)

C1--3 to 32 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; strongly effervescent, lime disseminated; moderately alkaline (pH 8.3); abrupt smooth boundary. (18 to 38 inches thick)

2C2--32 to 38 inches; light gray (2.5Y 7/2) light loam, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; discontinuous 1/8 inch silica-cemented laminar capping present, violently effervescent, lime disseminated; strongly alkaline (pH 8.8); abrupt smooth boundary. (3 to 7 inches thick)

2C3--38 to 39 inches; light gray (10YR 7/1) light loam, light gray (10YR 6/1) moist; strong medium platy structure; hard, firm, nonsticky and nonplastic; few very fine roots; few very fine interstitial pores; violently effervescent, lime disseminated; strongly alkaline (pH 8.8); abrupt smooth boundary. (1 to 2 inches thick)

2C4--39 to 42 inches; light gray (2.5Y 7/2) light loam, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; violently effervescent, lime disseminated; strongly alkaline (pH 8.8); abrupt smooth boundary. (2 to 4 inches thick)

2C5--42 to 45 inches; light gray (10YR 7/1) light loam, light gray (10YR 6/1 moist, with bands of light gray (2.5Y 7/1) and light brownish gray (2.5Y 6/1) moist; strong medium platy structure; hard, firm, nonsticky and nonplastic; few very fine roots; few very fine interstitial pores; strongly effervescent, lime disseminated; strongly alkaline (pH 8.9); abrupt smooth

boundary. (3 to 4 inches thick)

3C6--45 to 46 inches; light gray (2.5Y 7/2) sand, light brownish gray (2.5Y 6/2) moist; with yellow (2.5Y 7/6) mottles, olive yellow (2.5Y 6/6) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; strongly effervescent, lime disseminated; strongly alkaline (pH 8.9); abrupt smooth boundary. (1 to 2 inches thick)

4C7--46 to 60 inches; light olive gray (5Y 6/2) loam, olive gray (5Y 5/2) moist; moderate medium and coarse subangular blocky structure; hard, firm, nonsticky and nonplastic; few very fine roots; few very fine interstitial and tubular pores; violently effervescent, lime disseminated; strongly alkaline (pH 8.9).

Type Location: Mono County, California; about 14 miles east-northeast of Lee Vining; in Mono Valley; about 0.2 miles west of prominent drainageway in Sec. 36, 20 feet north of jeep trail in between 2 dunes in the NE¼NW¼SE¼ Sec. 36, T3N, R28E, M.D.B.M.

Range in Characteristics: Depth to the stratified lacustrine sediments is 20 to 36 inches. The soil between depths of 12 and 36 inches is usually dry from mid-May until mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to Dec. 20, and is above 8°C from April 15 to Nov. 30. Summer thunderstorms occur, but are spotty and usually do not wet the moisture control section. The mean annual soil temperature is 50 to 52°F. The mean January soil temperature is about 38°F; the mean July soil temperature is about 68°F. Ash content is 60 to 80 percent by weight in the A and upper C horizons, and 30 to 50 percent in the lower C horizon lake sediments. The soil surface is covered with 5 to 10 percent pumice gravel. The moist bulk density of the A and upper C horizons is 1.3 to 1.45 g/cc and the dry bulk density is 1.1 to 1.25 g/cc.

The A horizon has dry color of 10YR 7/2 or 6/2 and moist color of 10YR 5/2 or 4/2. It contains 5 to 10 percent fine pumice gravel and is mildly or moderately alkaline. It is noneffervescent.

The upper C horizon has colors and textures similar to the A horizon. It contains 0 to 5 percent fine pumice gravel and is slightly to strongly effervescent. Lime is disseminated and the soil contains slightly more soluble salts and exchangeable sodium than the A horizon. The soil reaction is mildly or moderately alkaline.

The lower C horizon has dry color of 5Y 6/2, 2.5Y 6/2, 7/2, 10YR 7/1, 7/2, or 8/1, and moist color of 5Y 4/2, 2.5Y 4/2, 5/2, 10YR 5/1, 5/2, or 6/1. Mottles with bright chroma are present in some horizons. This horizon consists of thin strata of silt loam, loam, or sand. The exchangeable sodium percentage ranges from 15 to 30. The soil reaction is moderately or strongly alkaline.

Geographic Setting: These soils are on hummocky lake terraces at elevations of 6,400 to 6,900 feet. Slopes are 2 to 9 percent. Dunes are associated with these soils in most areas. The soils formed in rhyolitic volcanic ash that was aerially deposited over finer-textured lakebed sediments. The ash has since been reworked by wind and water. The mean annual precipitation is 8 to 10 inches, much of it as snow. The mean January temperature is about 30°F;

the mean July temperature is about 67°F. The mean annual temperature is 45 to 48°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Brantel(T) and Deepwell(T) soils. These soils lack loamy strata in the control section.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; moderately slow permeability due to the sodic lake sediments.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is douglas rabbitbrush, Wyoming big sagebrush, gray horsebrush, little horsebrush, greasewood, rubber rabbitbrush, annual forbs, Indian ricegrass, needle and thread grass, inland saltgrass, Nevada dalea, and common pricklygilia. Utah juniper is present in some areas.

Distribution and Extent: Lake terraces around Mono Lake in Mono County, California. The soils are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Alameda Well.

Remarks: Alamedawell soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

AQUENTS

These soils are very deep, poorly or very poorly drained, and have formed in mixed alluvium. Slopes are 0 to 2 percent. The mean annual precipitation is 9 to 12 inches and the mean annual temperature is about 45°F.

Reference Pedon: loam - on a slope of less than 1 percent at 6,950 feet elevation under inland saltgrass vegetation. Colors are for dry soil unless otherwise stated. When described (10/31/78) the water table stood at a depth of 20 inches and the capillary fringe extended upward to a depth of about 4 inches.

The soil surface is covered with a thin, powdery film of white salts.

A--0 to 5 inches; white (10YR 8/1) loam, light brownish gray (10YR 6/2) moist; moderate medium prismatic structure; hard, friable, sticky and plastic; common very fine roots; common very fine interestitial and tubular pores; violently effervescent, lime disseminated; strongly alkaline (pH 8.5); clear smooth boundary.

C1--5 to 10 inches, white (10YR 8/1) loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; violently effervescent, lime disseminated; moderately alkaline (pH 8.3); clear smooth boundary.

C2--10 to 18 inches; white (10YR 8/1) silty clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, sticky and plastic; violently effervescent, lime disseminated; moderately alkaline (pH 8.3); clear smooth boundary.

C3--18 to 30 inches; saturated sandy loam.

Location: Mono County, California. About 8.75 miles east-northeast of the town of Mammoth Lakes; near the center of a playa-like area about ½ mile west of an open pit mine; at the southeast corner of the SE¼SW¼SW¼ Sec. 18, T3S, R29E, M.D.B.M.

Range in Characteristics: The whole soil is saturated in spring, and also through early summer in some pedons. During this period the water table stands at a depth of 0 to 24 inches and the capillary fringe reaches the soil surface. The soil temperature rises above 5°C in early May, while the soil is still saturated. During summer and fall, a very thin white salt crust is present on the soil surface in some areas. The mean annual soil temperature is 44 to 47°F. The soil contains 0 to 5 percent gravel. The mean summer soil temperature is 59 to 65°F.

Plate 39. Surface condition of the Aquents in foreground; Aquic Torriorthents in middle ground; Cowtrack Variant soils in background. Looking southeast from Big Sand Flat.

The A horizon has dry color of 10YR 7/1, 7/2, 8/1, 5Y 7/1, 7/2, 8/2, or 2.5Y 7/2. It has moist color of 10YR 5/2, 5/3, 6/2, or 2.5Y 5/2. The whitish dry colors are usually due to salt crystallization on the ped surface during drying. Textures are quite variable and include sandy loam, loam, or loamy sand. The A horizons are nonsaline or slightly saline with an electrical conductivity of 2 to 20 mmhos/cm. The exchangeable sodium percentage is 10 to 50. Structure is massive or prismatic. The soil is moderately to very strongly alkaline. Organic carbon content is less than 0.6 percent.

The C horizon has dry color of 5Y 7/2, 2.5Y 7/2, 10YR 7/1, 7/2, or 8/1. It has moist color of 5Y 5/2, 6/2, 2.5Y 5/2, 10YR 5/3, or 6/2. Prominent mottles with chroma of 1 or less are present in many pedons. The electrical conductivity is less than 1 mmhos/cm and the exchangeable sodium percentage is less than 10. The soil is neutral or moderately alkaline. Textures are silt loam, loam, sandy loam, silty clay loam, loamy sand, or coarse sand. Stratification is present in many pedons. Layers of hard tufa are present in some pedons around Mono Lake.

Geographic Setting: These soils occur in basin areas and on old lakeshores near underground springs. Slopes are 0 to 2 percent. Elevations are 6,400 to 7,000 feet. The soils formed in alluvium from granitic, basaltic, and pyroclastic rock sources. Most pedons contain some rhyolitic volcanic ash and some pedons have ashy mineralogy. The mean annual precipitation is 9 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Aquic Torriorthents. These soils are somewhat poorly drained and have a water table at depths of 3 to 5 feet during spring and summer.

Drainage and Permeability: Poorly or very poorly drained; very slow or ponded runoff; moderately slow permeability above the water table.

Use and Vegetation: Used for wildlife habitat and grazing. Vegetation is mainly inland saltgrass, alkali sacaton, Nevada bluegrass, and sedges.

Distribution and Extent: Basin areas east of the Sierra Nevada in Mono County, California. The soils are of small extent within the inventory area.

AQUIC TORRIORTHENTS

These soils are very deep, somewhat poorly drained, and have formed in mixed alluvium. Slopes are 0 to 2 percent. The mean annual precipitation is 9 to 12 inches and the mean annual temperature is about 45°F.

Reference Pedon: sandy loam - on a slope of less than 1 percent at 6,490 feet elevation under inland saltgrass, black greasewood, rubber rabbitbrush, and salt-tolerant forb vegetation. Colors are for dry soil unless otherwise stated. When described (8/9/79) the water table stood at a depth of 53 inches and the soil was slightly moist throughout the profile.

The soil surface has a discontinuous, thin, powdery film of white salts.

A--0 to 23 inches; white (N 8/0) sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine interstitial pores; violently effervescent, lime disseminated; very strongly alkaline (pH 10.0); abrupt wavy boundary.

C1--23 to 42 inches; light gray (2.5Y 7/2) sandy loam, grayish brown (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; mildly alkaline (pH 7.6); clear wavy boundary.

C2--42 to 60 inches; light gray (2.5Y 7/2) sandy loam, olive gray (5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine interestitial pores; 5 percent fine pebbles, mildly alkaline (pH 7.6).

Location: Mono County, California. About 4½ miles northwest of Antelope Mountain in Adobe Valley; 30 feet northwest of dirt road; in the NE¼NW¼NE¼ Sec. 24, T1N, R30E, M.D.B.M.

Range in Characteristics: The water table comes up to a depth of 3 to 5 feet during spring and summer. The soil temperature rises above 5°C in late April, and the mean annual soil temperature is 44 to 47°F. The mean summer soil

Plate 40. Surface condition of the Aquic Torriorthents in Adobe Valley. Looking north from the valley floor.

temperature is 59 to 65°F. During summer and fall, a very thin white salt crust is present on the soil surface in some areas. The soil contains 0 to 15 percent gravel. The textural control section of these soils is coarse-loamy or fine-loamy.

The A horizon has dry color of 10YR 7/1, 7/2, 8/1, 2.5Y 7/2, or N 8/0. It has moist color of 10YR 4/2, 5/2, 5/3, 6/2, or 2.5Y 5/2. The whitish dry colors are usually due to salt crystallization on the ped surfaces during drying. Textures are quite variable and include sandy loam, loamy sand, loam, and sand. The A horizon is nonsaline to strongly saline with an electrical conductivity of 2.0 to 20 mmhos/cm. The exchangeable sodium percentage is 15 to 50. Structure is massive or prismatic. The soil is moderately to very strongly alkaline. Boron content is 1 to 9 ppm. Organic carbon content is less than 0.6 percent and decreases regularly with depth.

The C horizon has dry color of 10YR 4/3, 6/1, 7/2, 7/4, 8/1, 5Y 7/2, 2.5Y, 7/2, or N 8/0. It has moist color of 10YR 3/1, 4/2, 4/3, 5/2, 5/3, 5/4, 5/6, 6/1, 6/2, 6/3, 6/4, 5Y 5/1, 5/2, or 2.5Y 5/2. Mottles with chroma of 1 or less are present in the lower C horizon in many pedons. Textures are sandy loam, silt loam, coarse sand, loamy sand, and gravelly sand. Some stratification is usually present. The electrical conductivity is less than 1 mmhos/cm and the exchangeable sodium percentage is 1 to 8. The soil is neutral to strongly alkaline. Layers of hard tufa are present in some pedons around Mono Lake.

Geographic Setting: These soils occur in basin areas and old lakeshores near underground springs. Slopes are 0 to 2 percent. Elevations are 6,400 to 7,000 feet. The soils formed in alluvium from granitic, basaltic, and pyroclastic rock sources. Most pedons contain some rhyolitic volcanic ash and some pedons have ashy mineralogy. The mean annual precipitation is 9 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Aquents, which are poorly or very poorly drained soils. They have a higher water table than the Aquic Torriorthents and are saturated throughout the soil profile for several weeks each May.

Drainage and Permeability: Somewhat poorly drained; very slow or ponded runoff; moderate permeability above the water table.

Use and Vegetation: Used for wildlife habitat and grazing. Vegetation is mainly inland saltgrass, alkali sacaton, rubber rabbitbrush, and black greasewood.

Distribution and Extent: Basin areas in valleys east of the Sierra Nevada in Mono County, California. The soils are of small extent within the inventory area.

ARIZO SERIES

The Arizo series consists of very deep, somewhat excessively drained soils that formed in granitic alluvium. Arizo soils are on gently to strongly sloping bouldery alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 4 to 6 inches, and the mean annual temperature is 57 to 59°F.

Taxonomic Class: Sandy-skeletal, mixed, thermic Typic Torriorthents

Typical Pedon: Arizo bouldery loamy coarse sand - on an 8 percent east slope at 3,800 feet elevation under creosotebush, allscale saltbush, white bursage, Cooper goldenbush, and white burrobush vegetation. Colors are for dry soil unless otherwise stated. When described (6/27/79) the soil was dry throughout.

Surface coverage of rock fragments: 2 percent boulders, 2 percent stones, 5 percent cobbles, and 20 percent pebbles; ¼ inch platy surface crust.

A--0 to 10 inches; pale brown (10YR 6/3) bouldery loamy coarse sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 2 percent boulders, 2 percent stones, 5 percent cobbles, and 15 percent pebbles; mildly alkaline (pH 7.5); clear wavy boundary. (3 to 20 inches thick)

C--10 to 60 inches; pale brown (10YR 6/3) very stony loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine interstitial and few very fine tubular pores; 15 percent stones, 15 percent cobbles, and 10 percent pebbles; mildly alkaline (pH 7.5).

Modal Location: Inyo County, California. About 3½ miles north of Olancha in Owens Valley; 30 feet north of dirt road branching off of aqueduct road; 36° 20' 11" N. Lat., 118° 1' 38" W. Long.

Range in Characteristics: These soils are usually dry from early April through November, and are intermittently moist in some part of the moisture control section the rest of the time. The control section is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 61 to 65°F. Rock fragments tent to be rounded or have rounded edges. The surface rock fragment coverage ranges from 30 to 90 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 20 to 50 percent gravel. Some boulders exceed 6 feet in diameter. The soil is mildly or moderately alkaline. Some profiles have disseminated lime that weakly effervesces.

The A horizon has dry color of 10YR 7/2 or 6/3. Rock fragment content ranges from 15 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 5 to 30 percent gravel. Textures are bouldery, very bouldery, or stony loamy coarse sand. Some profiles have thin fragile layers just below the surface that have vesicular pores. The organic carbon content is 0.2 to 0.4 percent.

The C horizon has dry color of 10YR 7/2, 7/3, 6/3, or 6/4, and moist color of 10YR 4/3, or 5/3. Rock fragment content is 35 to 75 percent for the 10 to 40 inch control section with 10 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 5 to 30 percent gravel. Textures are loamy coarse sand with very cobbly, very stony, or extremely stony modifiers. The organic carbon content is 0.1 to 0.3 percent.

Geographic Setting: Arizo soils have formed on recent bouldery, granitic alluvial fans and fan terraces. Many of these form long aprons along mountains range fronts. They tend to be dissected with a few drainageways and shallow washes. Slopes are 5 to 15 percent. Elevations range from 3,700 to 4,500 feet. The mean annual precipitation is 4 to 6 inches. The mean January temperature is about 39°F; mean July temperature is about 80°F; mean annual temperature is 57 to 59°F. The frost-free season is 200 to 225 days.

Geographically Associated Soils: These are the Bitter, Cajon, Garlock Variant, and Yellowrock soils. Bitter soils have loamy-skeletal argillic horizons. Cajon soils are sandy throughout. Garlock Variant soils have loamy argillic horizons. Yellowrock soils have sandy textural control sections that contain skeletal layers in the lower part.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Plate 41. Soil profile of Arizo bouldery loamy coarse sand on the west side of Owens Lake (near the community of Cartago).

Use and Vegetation: Used principally for grazing and wildlife habitat. Vegetation is mainly white bursage, Cooper goldenbush, spiny hopsage, desert needlegrass, galleta grass, Nevada ephedra, bud sagebrush, California buckwheat, Anderson wolfberry, white burrobush, allscale saltbush, shadscale, rayless goldenhead, creosotebush, common winterfat, and desert trumpet.

Distribution and Extent: Alluvial fans in California, Nevada, Arizona and New Mexico. The soils are of small extent within the inventory area.

Series Established: Clark County, Nevada, Virgin River Area, 1971.

AVALMOUNT SERIES

Avalmount soils are very deep, well drained, and contain many volcanic cinders. They are on lava flows with gently rolling to hilly topography. Slopes are 5 to 30 percent. The mean annual precipitation is 8 to 10 inches, some as snow, and the mean annual temperature is about 52°F.

Taxonomic Class: Cindery, mesic Xerollic Camborthids

Typical Pedon: Avalmount very gravelly fine sandy loam - on a 14 percent northeast slope at 5,150 feet elevation under big sagebrush, needleleaf rabbitbrush, and California buckwheat vegetation. Colors are for dry soil unless otherwise stated. When described (6/6/79) the soil was dry throughout.

Surface pavement of 2 percent stones, 15 percent cobbles, and 35 percent pebbles. Small rock outcrops dot the landscape.

A--0 to 10 inches; brown (10YR 5/3) very gravelly fine sandy loam, dark brown (10YR 3/3) moist; weak coarse and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine and medium roots; common very fine interstitial and few very fine tubular pores; 35 percent pebbles, 15 percent cobbles, and 2 percent stones; neutral (pH 7.3); gradual wavy boundary. (8 to 14 inches thick)

B1--10 to 30 inches; dark yellowish brown (10YR 4/4) very cobbly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; 20 percent pebbles, 25 percent cobbles, and 10 percent stones; neutral (pH 7.2); clear wavy boundary. (12 to 22 inches thick)

B2--30 to 60 inches; yellowish brown (10YR 5/4) extremely stony very fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine, fine and medium roots; common very fine interstitial and common very fine tubular pores; 20 percent pebbles, 20 percent cobbles, and 25 percent stones; neutral (pH 7.1).

Modal Location: Inyo County, California. About 3 miles southwest of Big Pine on Crater Mountain lava flow; 5 feet west of the dirt road in the SW¼NE¼SW¼ Sec. 36, T9S, R33E, M.D.B.M.

Range in Characteristics: Depth to hard lava is greater than 60 inches and in many areas is probably greater than 10 feet. All rock fragments are volcanic cinders. These are jagged and irregular in shape. The soil between depths of 10 and 40 inches contains 35 to 80 percent cinders. The soil is usually dry from early May through November, and is moist in some or all parts of the control section the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 55 to 59°F. A gravel, cobble, and stone pavement covers 40 to 60 percent of the soil surface. Surface stone coverage ranges from 1 to 3 percent. Base saturation is 90 to 100 percent throughout the profile. The fine-earth fraction contains about 50 percent volcanic ash by weight.

The A horizon has textures of very gravelly fine sandy loam or very cobbly fine sandy loam. It contains 35 to 60 percent cinders consisting of 1 to 3 percent stones, 5 to 20 percent cobbles, and 15 to 40 percent gravel. The organic carbon content is 0.5 to 0.6 percent for the horizon as a whole.

The B horizon contains 35 to 80 percent cinders consisting of 10 to 30 percent stones, 15 to 30 percent cobbles, and 15 to 30 percent gravel. Thin clay films are evident in some pedons. This is a cambic horizon.

Plate 42. Surface condition of the Avalmount soil, south of Big Pine. The gravel and cobbles are fragments of vesicular basaltic lava (cinders). Looking southeast towards Crater Mountain.

Geographic Setting: These soils are on basaltic lava flows originating from Crater Mountain, near Big Pine. Some of the fine-earth material is thought to be of aeolian origin. Elevation ranges from 4,800 to 6,000 feet. Slopes are gently rolling to hilly, 5 to 30 percent slopes. The mean annual precipitation is 8 to 10 inches with some in the form of snow. The mean January temperature is about 34°F; the mean July temperature is about 72°F. The mean annual temperature is about 52°F. The frost-free season is about 150 days. Lava rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Rovana(T), Taboose(T), and Tuttle(T) soils. Rovana soils have mixed mineralogy and have less than 35 percent rock fragments in the textural control section. Taboose soils lack a cambic horizon and have thermic soil temperature regimes. Tuttle soils have mixed mineralogy and formed in stony granitic alluvium.

Drainage and Permeability: Well drained; slow runoff; moderate permeability.

Use and Vegetation: At present, used for grazing and wildlife habitat. The vegetation is mainly big sagebrush, desert needlegrass, Indian ricegrass, bottlebrush squirreltail, Nevada ephedra, needleleaf rabbitbrush, California buckwheat, Fremont dalea, Dorr's sage, spiny hopsage, desert peach, annual forbs, and perennial forbs.

Distribution and Extent: Lava flows in east-central California. The soils are of small extent within the inventory area.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

BERENT FAMILY

The Berent family consists of moderately deep to very deep, somewhat excessively drained sandy soils. They are on steep hillsides bordering Owens Valley. Slopes are 30 to 50 percent. The mean annual precipitation is 10 to 12 inches, much of it as snow, and the mean annual temperature is 42 to 52°F.

Taxonomic Class: Mixed, mesic Xeric Torripsamments

Reference Pedon: Berent family gravelly loamy coarse sand - on a 44 percent east slope at 6,080 feet elevation under big sage, desert bitterbrush, and Douglas rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/25/79) the soil was dry throughout.

25 percent of the soil surface is covered with pebbles.

A1--0 to 2 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 15 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

A2--2 to 8 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine interstitial pores; 15 percent fine pebbles; neutral (pH 7.0); clear smooth boundary.

C1--8 to 26 inches; brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; 20 percent pebbles; neutral (pH 7.0); clear wavy boundary.

C2--26 to 61 inches; pale brown (10YR 6/3) cobbly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine interstitial pores; 15 percent pebbles, 10 percent angular cobbles; neutral (pH 6.9).

Location: Inyo County, California. About 10½ miles west-northwest of Lone Pine on Sierra Nevada escarpment; 200 yards west of dirt road on hillside; in the SW¼NE¼SW¼ Sec. 36, T14S, R34E, M.D.B.M.

Range in Characteristics: Depth to a lithic or paralithic contact ranges from 20 to more than 60 inches. The soil between depths of 10 and 40 inches is usually dry from late May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 47 to 58°F.

The A horizon has dry color of 10YR 6/3, 5/3, or 5/2, and moist color of 10YR 3/2, 3/3, or 4/3. Textures are loamy coarse sand or gravelly loamy coarse sand with 10 to 25 percent fine gravel. Structure is usually single grain on the surface and massive or weak subangular blocky in the A2 horizon. The organic carbon content is 0.3 to 0.6 percent.

The C horizon has dry color of 10YR 5/3, 5/4, 6/3, or 6/4, and moist color of 10YR 4/3, 5/3, or 5/6. Textures are gravelly or cobbly loamy coarse sand. Rock fragment content is 5 to 35 percent: 5 to 20 percent gravel and 0 to 15 percent cobbles. A Cr horizon is present in some areas.

Geographic Setting: These soils occur on steep hillsides with slopes of 30 to 50 percent. The soils formed in granitic residuum and colluvium. The elevation range is 5,600 to 8,000 feet. The mean annual precipitation is 10 to 12 inches, much of it as snow, and the mean annual temperature is 42 to 52°F. The mean January temperature is about 32°F; the mean July temperature is about 70°F. The frost-free season is 110 to 150 days. Rock outcrops are associated with these soils in some areas.

Geographically Associated Soils: These are the Glenbrook family soils. Glenbrook family soils are shallow to a paralithic contact.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of big sagebrush, desert bitterbrush, Douglas rabbitbrush, Dorr's

sage, Nevada ephedra, desert needlegrass, common winterfat, green Mormon-tea, and annual forbs.

Distribution and Extent: Escarpment of the Sierra Nevada and White Mountains in east-central California. The soils are of small extent within the inventory area.

BITTER SERIES

The Bitter series consists of very deep, well drained soils that formed in granitic alluvium. Bitter soils are on gently to strongly sloping bouldery alluvial fans and fan terraces. Slopes are 2 to 9 percent. The mean annual precipitation is 4 to 6 inches, and the mean annual temperature is 55 to 59°F.

Taxonomic Class: Loamy-skeletal mixed, thermic Typic Haplargids

Typical Pedon: Bitter bouldery loamy sand - on a 4 percent northeast slope at 3,840 feet elevation under white bursage, allscale saltbush, and shadscale vegetation. Colors are for dry soil unless otherwise stated. When described (3/78) the soil was moist above 20 inches.

Surface coverage of rock fragments: 2 percent boulders, 3 percent stones, 1 percent cobbles, and 45 percent fine pebbles.

A1--0 to 6 inches; pale brown (10YR 6/3) bouldery loamy sand, dark grayish brown (10YR 4/2) moist; massive, soft, very friable, nonsticky and nonplastic; few very fine and fine roots, many very fine interstitial pores; 2 percent boulders, 3 percent stones, 1 percent cobbles, and 15 percent fine pebbles; slightly effervescent with disseminated lime, moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 7 inches thick)

A2--6 to 8 inches; light gray (2.5YR 7/2) bouldery loam, light olive brown (2.5YR 5/4) moist; weak fine platy structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few fine and many very fine vesicular pores; 2 percent boulders, 3 percent stones, 1 percent cobbles, and 10 percent fine pebbles; violently effervescent with disseminated lime; moderately alkaline (pH 8.0); abrupt wavy boundary. (0 to 4 inches thick)

Bt1--8 to 22 inches; brownish yellow (10YR 6/6) very gravelly heavy sandy loam, dark yellowish brown (10YR 4/6) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, few fine, and few coarse roots; few very fine tubular pores; common moderately thick clay films in pores and bridging mineral grains; 10 percent decomposing cobbles and 30 percent pebbles; slightly effervescent with disseminated lime; mildly alkaline (pH 8.0); abrupt wavy boundary. (0 to 20 inches thick)

Bt2--22 to 30 inches; brownish yellow (10YR 6/6) very cobbly heavy sandy loam, dark yellowish brown (10YR 4/6) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; common moderately thick clay films in pores and bridging mineral grains; 10 percent decomposing stones, 25 percent decomposing cobbles,

and 20 percent pebbles; slightly effervescent with disseminated lime; mildly alkaline (pH 8.0); clear wavy boundary. (10 to 30 inches thick)

C--30 to 60 inches; light gray (2.5Y 7/2) very cobbly sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 5 percent decomposing stones, 15 percent decomposing cobbles, and 20 percent pebbles; slightly effervescent with disseminated lime; moderately alkaline (pH 8.0).

Modal Location: Inyo County, California. About 6 miles northwest of Lone Pine in Owens Valley, 20 yards south of dirt road near large boulder; in the NW¼SW¼SE¼ Sec. 25, T14S, R35E, M.D.B.M.

Range in Characteristics: These soils are usually dry from early April through November, and are intermittently moist in some part of the moisture control section the rest of the time. The control section is not moist for as long as 90 consecutive days in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 64°F. Rock fragments tend to be rounded or have rounded edges. Some profiles are noncalcareous. The surface rock fragment coverage ranges from 30 to 90 percent with 3 to 15 percent boulders and stones, 1 to 20 percent cobbles, and 5 to 50 percent gravel (mostly fine). Some boulders exceed 6 feet in diameter. The soil is moderately alkaline.

The A horizon has dry color of 10YR 6/3, 7/3, or 2.5YR 7/2, and moist color of 10YR 4/2, 4/3, 5/3, or 2.5Y 5/4. Rock fragment content ranges from 15 to 60 percent with 3 to 15 percent boulders and stones, 1 to 20 percent cobbles, and 5 to 30 percent gravel. Many pedons have fragile, loamy vesicular layers just below the surface. The organic carbon content is 0.2 to 0.3 percent.

The B horizon has dry color of 10YR 5/6, 6/4, 6/6, or 7.5YR 6/6, and moist color of 10YR 4/4, 4/6, or 7.5YR 4/6. Rock fragment content ranges from 35 to 75 percent with 3 to 50 percent boulders and stones, 10 to 30 percent cobbles, and 5 to 30 percent gravel. Textures are sandy loam or sandy clay loam with very gravelly or very cobbly modifiers. Clay films are thin to moderately thick, and are few to many. Clay content is 15 to 30 percent.

The C horizon has dry color of 10YR 6/3, 6/4, 7/3, or 2.5YR 7/2, and moist color of 10YR 4/3, 4/4, 5/3, or 2.5Y 5/4. Rock fragment content and textural modifiers are similar to the B horizon. Textures are loamy coarse sand or sandy loam.

Geographic Setting: Bitter soils formed on older alluvial fans and fan terraces. These form long aprons along mountain range fronts. The fans tend to be dissected with a few drainageways and shallow washes. Slopes are 2 to 9 percent. Elevations range from 3,700 to 4,500 feet. The mean annual precipitation is 4 to 6 inches. The mean January temperature is about 39°F; mean July temperature is about 79°F; mean annual temperature is 55 to 59°F. The frost-free season is 200 to 225 days.

Geographically Associated Soils: These are the Arizo, Cajon, Garlock Variant and Yellowrock soils. The Arizo, Cajon and Yellowrock soils do not have argillic horizons. Arizo soils have sandy-skeletal control sections. Garlock

Variant soils have fine-loamy textural control sections. Cajon and Yellowrock have sandy control sections.

Drainage and Permeability: Well drained; slow runoff; moderately slow to moderately rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly white bursage, shadscale, allscale saltbush, fourwing saltbush, Cooper goldenbush, and bud sagebrush with some Nevada ephedra, white burrobush, spiny hopsage, longspine horsebrush, needleleaf rabbitbrush, common winterfat, California buckwheat, creosotebush, and blackbrush.

Distribution and Extent: Alluvial fans in the Owens Valley region of east-central California. The soils are of small extent within the inventory area.

Series Established: BLM Kingston-Amargosa Area Soil Survey, Parts of Inyo and San Bernardino Counties, California, 1979.

BRANTEL SERIES

The Brantel series consists of very deep, somewhat excessively and excessively drained soils that formed in volcanic ash. Brantel soils are on nearly level to rolling valley floors, lake terraces, fan terraces and alluvial fans. Slopes are 0 to 15 percent. The mean annual precipitation is 8 to 12 inches and the mean annual temperature is 44° to 53°F.

Taxonomic Class: Ashy, mesic Xeric Torripsamments

Typical Pedon: Brantel gravelly loamy sand - on a 2 percent northeast slope at 6,640 feet elevation under big sagebrush and rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/11/79) the soil was dry throughout.

15 percent of the soil surface is covered with fine and medium pumice pebbles.

A--0 to ½ inch; light gray (10YR 7/2) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 15 percent pumice and obsidian pebbles; neutral (pH 7.3); clear smooth boundary. (½ to 2 inches thick)

C1--½ to 32 inches; light gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; 5 percent pumice and obisdian pebbles; neutral (pH 7.0); gradual wavy boundary. (10 to 60 inches thick)

2C2--32 to 60 inches; light gray (10YR 7/2) gravelly sand, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 15 percent pumice and obsidian pebbles; mildly alkaline (pH 7.7).

Type Location: Mono County, California. About 3½ miles west-southwest of Antelope Mountain in Adobe Valley. Thirty feet north of dirt road running SW-NE at center of NE¼ Sec. 12, T1S, R30E, M.D.B.M.

Range in Characteristics: The soil is usually dry from mid-May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to Nov. 30. Summer thundershowers occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is 47 to 59°F. Base saturation is 90 to 100 percent throughout the profile. Ash content is 60 to 100 percent by weight. The dry bulk density ranges from 1.1 to 1.25 g/cc, and the moist bulk density is 1.3 to 1.45 g/cc. Fine and medium gravel covers 10 to 35 percent of the soil surface. All rock fragments on the surface and in the profile are pumice and/or obsidian.

The A horizon has dry color of 10YR 6/2, 6/3, or 7/2 and moist color of 10YR 4/2, 4/3, 5/2, or 5/3. Textures are loamy sand, gravelly loamy sand, coarse sand, or gravelly coarse sand. Clay content is 1 to 6 percent. Gravel content ranges from 5 to 35 percent, with most of it concentrated in the surface inch. Organic carbon content is 0.2 to 0.35 percent. The soil is slightly acid to neutral.

The C horizon has dry color of 10YR 6/3, 7/1, 7/2, 7/3, 7/4, or 8/2, and moist color of 10YR 4/3, 5/1, 5/2, 5/3, 5/4, or 6/2. Textures are loamy sand, coarse sand, gravelly coarse sand, sand, or gravelly sand. Clay content is 1 to 6 percent. Stratification is present in some pedons, but no very gravelly or loamy lenses are present. Gravel content ranges from 5 to 35 percent. The soil is neutral or mildly alkaline.

Geographic Setting: Brantel soils are on alluvial fans, fan terraces, lake terraces, and valley floors at elevations of 5,300 to 7,600 feet. Slopes are 0 to 15 percent. The soils formed in rhyolitic volcanic ash. The mean annual precipitation is 8 to 12 inches, mostly as snow. Mean annual snowfall is 40 to 100 inches. The mean January temperature is 30 to 34°F; the mean July temperature is 67 to 72°F. The mean annual temperature is 44 to 53°F. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Alamedawell(T), Buscones(T), Deepwell(T), Pizona(T), Sawavu(T), Sherwin(T), Wellington, and Zono(T) soils. Alamedawell soils are ashy over loamy. Buscones soils are 20 to 40 inches deep over soft tuff. Deepwell soils formed in aeolian dunes consisting mostly of fine and medium sands, and lack gravel. Pizona soils are 40 to 60 inches deep with more than 35 percent rock fragments in their argillic horizons. Sherwin soils are shallow over hard tuff. Wellington and Sawavu soils have duripans. Zono soils are ashy over loamy and have hard bedrock at depths of 40 to 60 inches.

Drainage and Permeability: Somewhat excessively or excessively drained; very slow runoff; rapid permeability in loamy sand textures and very rapid permeability in coarse sand textures.

Use and Vegetation: Used for grazing, wildlife habitat, and recreation. Vegetation is mainly big sagebrush, Douglas rabbitbrush, antelope bitterbrush, rubber rabbitbrush, Nevada ephedra, Indian ricegrass, staghorn cholla, spiny

hopsage, longspine horsebrush, Fremont dalea, Indian ricegrass, needle and thread grass, western needlegrass, and annual forbs.

Distribution and Extent: Alluvial fans, fan terraces, lake terraces, and valley floors in east-central California. The soils are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series name is coined.

Remarks: Brantel soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

BRANTEL VARIANT

Brantel Variant soils are very deep, excessively drained, and formed in deposits of rhyolitic ash and cinders. They are on lake terraces and around cinder cones. Slopes are 2 to 15 percent. The mean annual precipitation is about 12 inches, much of it as snow, and the mean annual air temperature is about 45°F.

Taxonomic Class: Cindery, mesic Xeric Torriorthents

Typical Pedon: Brantel Variant gravelly sand - on a 5 percent west slope at 6,570 feet elevation under big sagebrush, desert peach, and antelope bitterbrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/8/79), the soil was dry throughout.

Surface covered with 2 percent cobbles and 30 percent pebbles (pumice and obsidian fragments).

A1--0 to 5 inches; light brownish gray (10YR 6/2) gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 30 percent fine pumice pebbles; slightly acid (pH 6.1); abrupt smooth boundary. (3 to 5 inches thick)

2A2--5 to 9 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt smooth boundary. (2 to 5 inches thick)

3C--9 to 60 inches; light gray (10YR 7/2) extremely gravelly coarse sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine interstitial pores; 1 percent stones, 5 percent cobbles, and 55 percent pebbles (pumice and obsidian fragments); slightly acid (pH 6.4).

Modal Location: Mono County, California. About $3\frac{1}{2}$ miles southeast of Lee Vining, near Panum Crater; 8 feet east of dirt road; in the $NE\frac{1}{4}NW\frac{1}{4}NE\frac{1}{4}$ Sec. 24, T1N, R26E, M.D.B.M.

Range in Characteristics: All rock fragments are pumice and obsidian. The particle size control section contains 35 to 70 percent rock fragments. The sand fraction is ashy. The ash, pumice, and obsidian make up at least 60 percent of the soil by weight. The soil between depths of 12 to 40 inches is usually dry from mid-May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thundershowers occur but are sporadic and usually do not wet the control section. The mean annual soil temperature is about 50°F. Base saturation is 90 to 100 percent. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 6/2 or 7/2, and moist color of 10YR 4/2 or 5/2. Textures are sand, loamy sand, or gravelly sand. Structure is single grain or massive. Gravel content is 10 to 30 percent.

The C horizon has dry color of 10YR 6/1, 7/1, 7/2, or 8/2. Textures are very gravelly coarse sand or extremely gravelly coarse sand. Pumice and obsidian pebbles make up 35 to 65 percent of the soil volume. Cobble and stone content is 1 to 10 percent, with cobbles predominating.

Plate 43. Brantel and Brantel Variant soils in Pumice Valley (near Lee Vining) receive an average of about 65 inches of snow each year. This photo was taken during the very wet winter of 1977-78. Looking southeast across Pumice Valley toward the Mono Craters.

Geographic Setting: These soils occur around Panum Crater near Mono Lake at elevations of 6,500 to 7,000 feet. Slopes are 2 to 15 percent. The soils formed in aerial ash and cinder deposits. The mean annual precipitation is about 12 inches, much of it as snow. The mean January temperature is about 29°F; mean July temperature is about 66°F. The mean annual temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: This is the Brantel(T) soil. Brantel soils have ashy particle-size control sections.

Drainage and Permeability: Excessively drained; very slow runoff; rapid or very rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is big sagebrush, desert peach, antelope bitterbrush, Douglas rabbitbrush, Indian ricegrass, annual forbs, common pricklygilia, and rubber rabbitbrush.

Distribution and Extent: Mono Basin in eastern California. The soils are of small extent within the inventory area.

BUSCONES SERIES

The Buscones series consists of moderately deep, somewhat excessively drained, sandy soils that formed from soft rhyolitic tuff. Buscones soils are on undulating to hilly topography with slopes of 2 to 30 percent. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is 45 to 50°F.

Taxonomic Class: Ashy, mesic Xeric Torripsamments

Typical Pedon: Buscones very gravelly loamy sand - on an 11 percent northeast slope at 5,820 feet elevation under big sagebrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/12/79) the soil was dry throughout.

A1--0 to ½ inch; light gray (10YR 7/2) very gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 40 percent pumice pebbles; neutral (pH 6.9); abrupt smooth boundary. (½ to 1 inch thick)

A2--½ to 2 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 5 percent pumice pebbles; neutral (pH 6.9); clear wavy boundary. (1 to 3 inches thick)

A3--2 to 18 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 5 percent pumice pebbles; neutral (pH 6.9); gradual smooth boundary. (10 to 20 inches thick)

C--18 to 31 inches; white (10YR 8/2) gravelly loamy sand, light brownish gray (10YR 6/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 15 percent fine and medium pumice pebbles; neutral (pH 6.8); abrupt wavy boundary. (8 to 18 inches thick)

Cr--31 to 40 inches; white (N 8/0) softly consolidated rhyolitic tuff; slightly hard; diggable with spade; 25 percent pumice pebbles.

Type Location: Mono County, California. About 1.75 miles north of Benton Hot Springs; thirty feet northeast of dirt road at the northeast corner of SE¼SE¼ SW¼ Sec. 26, T1S, R31E, M.D.B.M.

Range in Characteristics: Depth to the soft tuff is 20 to 40 inches. The soil between depths of 10 and 40 inches is usually dry from mid-May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to Dec. 20, and is above 8°C from April 15 to Nov. 30. The mean annual soil temperature is 51 to 59°F. Base saturation is 90 to 100 percent throughout the profile. The moist bulk density of the soil is 1.3 to 1.45 g/cc, and the dry bulk density is 1.1 to 1.25 g/cc. Ash content is 60 to 100 percent by weight. Fine and medium pumice gravel covers 15 to 50 percent of the soil surface.

The A horizon has dry color of 10YR 6/2, 6/3, or 7/2, and moist color of 10YR 4/2, 4/3, or 5/2. The upper A horizon is usually loose. Gravel content is 15 to 50 percent for the A1 horizon, and is 5 to 15 percent in the A2 and A3 horizons. Textures in the A1 horizon are gravelly or very gravelly loamy sand. The gravel is mostly pumice. The organic carbon content is 0.1 to 0.3 percent.

The C horizon has dry color of 7.5YR 8/2, 10YR 8/1, 8/2, or 7/2, and moist color of 7.5YR 6/2, 10YR 6/1, 6/2 or 5/2. Textures are loamy sand or gravelly loamy sand. Gravel content is 5 to 30 percent. The gravel is mostly pumice.

Geographic Setting: Buscones series are on undulating to hilly rhyolitic tuff deposits with slopes of 2 to 30 percent. The elevation range is 5,200 to 7,400 feet. The mean annual precipitation is 8 to 10 inches, some as snow. The mean January temperature is about 32°F; mean July temperature is about 70°F. The mean annual temperature is 45 to 50°F. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Brantel(T), Sawavu(T), and Sherwin(T) soils. Brantel soils are very deep and have formed in ashy alluvium. Sawavu soils are on terrace landscapes and have a weak duripan. Sherwin soils are shallow over hard tuff.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: At present, used for rangeland, wildlife habitat, and commerical pumice mining in some spots. The vegetation is big sagebrush, Douglas rabbitbrush, Indian ricegrass, desert needlegrass, annual forbs, bottlebrush squirreltail, bud sagebrush, perennial forbs, Nevada ephedra, Nevada dalea, longspine horsebrush, spiny hopsage, and fourwing saltbush.

Singleleaf pinyon, desert bitterbrush, and Utah juniper occur in some areas within the Benton Range.

Distribution and Extent: Buscones soils occur on volcanic formations in east-central California. They are moderately extensive.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series name comes from Buscones Peak on Blind Spring Hill.

Remarks: Buscones soils have an aridic moisture regime that borders on xeric. Cold soil temperatures in the winter prevent their meeting all the xeric moisture regime requirements. Buscones soils mapped in unit 116 are taxadjunct to the Buscones series because they have mixed mineralogy, are underlain by harder bedrock, and are in a higher precipitation zone. These differences, however, do not greatly affect use and management.

CAJON SERIES

The Cajon series consists of very deep, somewhat excessively drained soils that formed in granitic alluvium. They are on alluvial fans and fan terraces. Slopes are 0 to 5 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is about 60°F.

Taxonomic Class: Mixed, thermic Typic Torripsamments

Typical Pedon: Cajon gravelly loamy coarse sand - on a slope of less than 1 percent at 3,600 feet elevation under shadscale, bud sagebrush, and white bursage vegetation. Colors are for dry soil unless otherwise stated. When described (6/17/79) the soil was dry throughout.

20 percent of the soil surface is covered with fine granitic pebbles.

A--0 to 3 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 15 percent fine pebbles; mildly alkaline (pH 7.7); clear wavy boundary. (2 to 14 inches thick)

C1--3 to 54 inches; light gray (10YR 7/2) gravelly coarse sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 25 percent fine pebbles; moderately alkaline (pH 8.0); clear wavy boundary. (15 to 25 inches thick)

2C2--54 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 25 percent coarse pebbles; moderately alkaline (pH 8.4).

Modal Location: Inyo County, California. About 4 miles north of Cartago and ¼ mile east of Hwy. 395; 5 feet east of dirt road; 118° 1' 5"W., 36° 22' 44" N.

Range in Characteristics: The soil between depths of 10 and 40 inches is usually dry from early April through November, and is intermittently moist in some part the rest of the time. It is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 62 to 66°F. The soil is mildly to moderately alkaline.

The A horizon has dry color of 10YR 6/3, 6/4, or 7/3, and moist color of 10YR 4/3, 4/4, or 5/3. Textures are loamy sand or gravelly loamy sand with 5 to 25 percent fine pebbles. Effervescence is absent or slight with disseminated lime. The exchangeable sodium percentage is 2 to 5. The organic carbon content is 0.1 to 0.3 percent.

The C horizon has dry color of 10YR 7/2, 7/4, or 6/4, and moist color of 10YR 5/2, 5/4, or 4/3. Textures are loamy coarse sand, gravelly coarse sand, or gravelly loamy coarse sand with 5 to 35 percent gravel. The soil reaction is mildly to moderately alkaline. Effervescence is absent or slight with disseminated lime. The electrical conductivity of the saturation extract is 0.3 to 1.0 mmhos/cm. The exchangeable sodium percentage is 4 to 12. No loamy or very gravelly lenses are present.

Geographic Setting: Cajon soils are on alluvial fans and floodplains and have slopes of 0 to 5 percent. They formed in sandy granitic alluvium at elevations of 3,600 to 4,500 feet. The mean annual precipitation is 4 to 6 inches, all in the winter months. The mean January temperature is about 40°F; mean July temperature is about 80°F. The mean annual temperature is about 60°F. The frost-free season is 190 to 225 days.

Geographically Associated Soils: These are the Arizo, Seaman, Yellowrock, and Yermo soils. Arizo and Yermo soils have more than 35 percent rock fragments in the textural control section. Yellowrock soils have very gravelly or loamy strata in the textural control section. Seaman soils have coarse-loamy textural control sections.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of shadscale, bud sagebrush, white bursage, allscale saltbush, white burrobush, Nevada ephedra, common winterfat, Indian ricegrass, desert needlegrass, annual forbs, spiny hopsage, and fourwing saltbush.

Distribution and Extent: Alluvial fans, fan terraces, and floodplains in southeastern California, southern Nevada, and Arizona. The soils are of small extent within the inventory area.

Series Established: Central-Southern California Reconnaissance, 1917.

CASHBAUGH SERIES

The Cashbaugh series consists of shallow and very shallow, somewhat excessively drained soils on lake terraces. They are on nearly level to undulating terrain with slopes of 0 to 5 percent. The mean annual precipitation is 8 to 13 inches and the mean annual temperature is about 45°F.

Taxonomic Class: Mixed, mesic Lithic Torripsamments

Typical Pedon: Cashbaugh gravelly loamy sand - on a 2 percent southeast slope at 6,950 feet elevation under big sagebrush, Douglas rabbitbrush, and antelope bitterbrush vegetation. Colors are for dry soil unless otherwise stated. When described (10/4/79) the soil was dry throughout.

15 percent of the soil surface is covered with pebbles.

A1--0 to 1 inch; grayish brown (10YR 5/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 15 percent fine and medium pebbles; neutral (pH 6.8); abrupt smooth boundary. (1 to 3 inches thick)

A2--1 to 10 inches; brown (10YR 5/3) loamy sand, dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent fine and medium pebbles; neutral (pH 6.9); abrupt wavy boundary. (4 to 17 inches thick)

R--10 inches; hard tuffaceous sandstone bedrock; can be broken in large horizontal plates with backhoe.

Type Location: Mono County, California. About 6 miles northwest of the Crowley Lake dam; 15 feet south of dirt road, just west of bend in road; at the SW corner of the NE¼SW¼SW¼ Sec. 28, T3S, R29E, M.D.B.M.

Range in Characteristics: Depth to hard tuffaceous sandstone or conglomerate bedrock is 5 to 20 inches. The soil above the bedrock is usually dry from mid-May through mid-November, and is moist in some or all parts the rest of time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer and fall thunderstorms occur, but are sporadic and usually do not significantly wet the control section. The soil moisture regime is aridic bordering on xeric. The mean annual soil temperature is about 48°F. The soil surface is covered with 10 to 25 percent gravel.

The A horizon has dry color of 10YR 5/2, 5/3, 6/2, or 6/3, and moist color of 10YR 3/2, 3/3, 4/2, or 4/3. Textures are loamy sand or gravelly loamy sand with 5 to 15 percent rock fragments. Cobbles (bedrock fragments) are present in some areas and make up 0 to 3 percent of the soil volume. Some of the rock fragments are pumice and obsidian. Organic carbon content is 0.4 to 0.5 percent. Base saturation is 90 to 100 percent. Rhyolitic volcanic ash makes up 40 to 60 percent of the soil by weight. The soil is slightly acid to neutral.

The R contact is considered lithic and usually has a horizontal cleavage.

Geographic Setting: Cashbaugh soils are on old lake terraces. They have formed in mixed alluvium and volcanic ash deposited on tuffaceous sandstone and conglomerate bedrock. Slopes are 0 to 5 percent. The elevation range is 6,500 to 7,400 feet. The mean annual precipitation is 8 to 13 inches, mostly as snow. Mean annual snowfall is 60 to 90 inches. The mean January temperature is about 30°F; the mean July temperature is about 67°F. The mean annual temperature is 44 to 47°F. The frost-free season is 120 to 140 days.

Geographically Associated Soils: These are the Brantel(T) and Zono(T) soils. Brantel soils are very deep, ashy, alluvial soils. Zono soils are deep, ashy soils over bedrock.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. The vegetation is mainly big sagebrush, Douglas rabbitbrush, antelope bitterbrush, Indian ricegrass, western needlegrass, blue wildrye, needle and thread grass, common pricklygilia, Sandberg bluegrass, sulfur buckwheat, basin wildrye, lupine, and perennial forbs.

Distribution and Extent: Crowley Lake basin in east-central California. The soils are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: Cashbaugh series is named after the Cashbaugh Ranch near Crowley Lake.

Remarks: Cashbaugh soils have aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements. The Cashbaugh soils mapped in unit 117 are taxadjunct to the Cashbaugh series bacause they havd ashy mineralogy, have less than 0.4% organic carbon, and are underlain by hard rhyolitic tuff. These differences, however, do not greatly affect their use and management.

CHIDAGO SERIES

The Chidago series consists of moderately deep, somewhat excessively drained sandy soils that formed from soft rhyolitic tuff. Chidago soils are on undulating to gently rolling topography with slopes of 2 to 9 percent. The mean annual precipitation is 6 to 8 inches and the mean annual temperature is 53 to 54°F.

Taxonomic Class: Ashy, thermic Xeric Torripsamments

Typical Pedon: Chidago gravelly loamy sand - on a 4 percent south slope at 4,810 feet elevation under Nevada ephedra, Fremont dalea, and fourwing salt-

bush vegetation. Colors are for dry soil unless otherwise stated. When described (8/12/79) the soil was dry throughout.

20 percent of the soil surface covered with fine and medium pumice pebbles.

A1--0 to ½ inch; light brown (7.5YR 6/4) gravelly loamy sand, brown (7.5YR 5/4) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 20 percent pumice pebbles; neutral (pH 7.3); clear wavy boundary. (½ to 1 inch thick)

A2--½ to 8 inches; light brown (7.5YR 6/4) loamy sand, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 5 percent pumice pebbles; neutral (pH 7.3); clear wavy boundary. (4 to 10 inches thick)

C--8 to 36 inches; pink (5YR 7/4) loamy sand, reddish brown (5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine interstitial pores; 5 percent pumice pebbles; mildly alkaline (pH 7.6); clear irregular boundary. (12 to 30 inches thick)

Cr--36 to 60 inches; pink (5YR 7/4) softly consolidated rhyolitic tuff, reddish yellow (5YR 6/6) moist; massive; few very fine and fine roots along fracture planes; can be dug with a spade with difficulty.

Type Location: Mono County, California. About 2 miles west-northwest of Hammil; 50 feet northwest of Blackrock Mine Road; in the NE¼SE¼NW¼ Sec. 15, T3S, R32E, M.D.B.M.

Range in Characteristics: Depth to the soft tuff is 20 to 40 inches. The soil between depths of 10 and 40 inches is usually dry from the end of April through November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 60°F. Base saturation is 90 to 100 percent throughout the profile. Ash content is 60 to 100 percent by weight. The soil surface is covered with 15 to 30 percent fine and medium gravel. All rock fragments are pumice fragments, both on the surface and in the profile.The soil is neutral or mildly alkaline.

The A horizon has dry color of 7.5YR 6/4, 7/4, or 10YR 7/3, and moist color of 7.5YR 4/4, 5/4, or 10YR 5/3. Gravel content is 5 to 30 percent, with most of the gravel in the surface inch. The soil surface usually has a loose consistency. The organic carbon content is 0.1 to 0.3 percent.

The C horizon has dry color of 5YR 7/4, and moist color of 5YR 5/4 or 7.5YR 5/4. Textures are loamy sand or gravelly loamy sand. Gravel content is 5 to 20 percent.

Geographic Setting: Chidago soils are on undulating rhyolitic tuff deposits. Slopes are 2 to 9 percent. The elevation range is 4,400 to 5,400 feet. The mean annual precipitation is 6 to 8 inches, some as snow. The mean January temperature is about 36°F; mean July temperature is about 74°F. The mean annual temperature is 53 to 54°F. The frost-free season is about 150 days.

Geographically Associated Soils: These are the Hammil(T) and Honova(T) soils. Hammil soils are formed in very deep alluvium. Honova soils are shallow over hard tuff.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: At present, used for rangeland, wildlife habitat, and commercial pumice mining in some spots. The vegetation is Nevada ephedra, Fremont dalea, shadscale, fourwing saltbush, Nevada dalea, longspine horsebrush, spiny hopsage, desert needlegrass, Indian ricegrass, common winterfat, annual forbs, bud sagebrush, spiny menodora, and staghorn cholla.

Distribution and Extent: Chidago soils occur on volcanic formations in east central California. They are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Chidago Canyon.

Remarks: Chidago soils have an aridic moisture regime bordering on xeric.

COWTRACK SERIES

The Cowtrack series consists of deep, somewhat excessively drained soils that formed in volcanic ash. Cowtrack soils are on undulating to hilly topography and have slopes of 2 to 30 percent. The mean annual precipitation is 12 to 14 inches and the mean annual temperature is about 40°F.

Taxonomic Class: Ashy over loamy, mixed, nonacid, frigid Xeric Torriorthents

Typical Pedon: Cowtrack loamy sand - on a 9 percent east slope at 8,240 feet elevation under big sagebrush, antelope bitterbrush, and rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/4/80) the soil was moist below 1 inch.

10 percent of the soil surface is covered with fine and medium pumice pebbles.

A--0 to 2 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent fine pumice pebbles; slightly acid (pH 6.1); abrupt smooth boundary. (2 to 3 inches thick)

C1--2 to 25 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 1 percent pumice pebbles; slightly acid (pH 6.3) abrupt wavy boundary. (8 to 25 inches thick)

2C2--25 to 34 inches; light brownish gray (10YR 6/2) heavy loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; 1 percent fine pumice pebbles; slightly acid (pH 6.4); gradual wavy boundary. (6 to 10 inches thick)

3Btb1--34 to 44 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine tubular and common very fine interstitial pores; 1 percent pebbles, 1 percent cobbles, and 1 percent stones; common thin clay films bridging mineral grains; neutral (pH 6.6); clear wavy boundary. (6 to 12 inches thick)

3Btb2--44 to 50 inches; light brownish gray (2.5Y 6/2) heavy sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular and interstitial pores; 5 percent pebbles, 1 percent cobbles, and 1 percent stones; common thin clay films in pores and on ped faces, and many thin clay films bridging mineral grains; neutral (pH 6.8); clear wavy boundary. (3 to 6 inches thick)

3Cr--50 to 58 inches; mixed light gray and pale yellow (2.5Y 7/2, 7/4) weathered, noncalcareous, fractured dacite, light brownish gray and light yellowish brown (2.5Y 6/2, 6/4) moist; diggable with spade when moist; average fracture spacing is 3 inches; gradual wavy boundary. (0 to 10 inches thick)

3R--58 inches; hard, fractured, noncalcareous dacite.

Type Location: Mono County, California. About 15½ miles east of Lee Vining on Cowtrack Mountain; 20 feet northwest of dirt road, just before last bend in road before going down to the intersection; in the NW¼SW¼SW¼ Sec. 18, T1N, R29E, M.D.B.M.

Range in Characteristics: Depth to hard bedrock is 40 to 60 inches. The ashy overburden ranges from 24 to 36 inches thick. The soil is usually dry in all parts from late May to mid-November, and is usually moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 15 to December 1, and is above 8°C from April 30 to November 15. Summer thunderstorms occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is 44 to 47°F. Mean summer soil temperatures are 59 to 64°F. Base saturation is 90 to 100 percent. Ash content is 60 to 100 percent in the ashy overburden. Dry bulk density of the ashy overburden is 1.1 to 1.25 g/cc. The moist bulk density is 1.3 to 1.45 g/cc. The soil surface is covered with 5 to 15 percent pumice gravel. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 6/2, 6/3, or 7/1, and moist color of 10YR 4/2, 4/3, or 5/1. The soil contains 0 to 5 percent fine pumice gravel. The organic carbon content is 0.45 to 0.55 percent.

The C horizon colors and texture are similar to the A horizon. Two ash deposits are usually represented in this horizon.

The buried B horizon has dry color of 10YR 5/3, 5/4, 6/2, 6/4, or 2.5Y 6/2, and moist color of 10YR 3/3, 3/4, 4/2, 4/4, or 2.5Y 4/2. Textures are sandy loam, clay loam, or loam. Rock fragment content is 5 to 15 percent consisting of 5 to 10 percent gravel and 1 to 5 percent cobbles and stones.

Geographic Setting: Cowtrack soils are on undulating to hilly uplands at elevations of 7,800 to 8,800 feet. Slopes are 2 to 30 percent. The soils formed in volcanic ash showered on top of buried loamy soils from dacite, andesite, granitic, or basaltic bedrock. The mean annual precipitation is 12 to 14 inches, mostly as snow. Mean annual snowfall is 100 to 130 inches. Mean January temperature is about 26°F; mean July temperature is about 57°F. The mean annual temperature is 39 to 42°F. The frost-free season is 75 to 100 days. Some rock outcrops are associated with Cowtrack soils.

Geographically Associated Soils: This is the Zono(T) series. Zono soils have mesic soil temperature regimes.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly big sagebrush, antelope bitterbrush, Douglas rabbitbrush, Indian ricegrass, needle and thread grass, western needlegrass, blue wildrye, spiny hopsage, sulfur flower, common pricklygilia, perennial forbs, lupine, and basin wildrye.

Distribution and Extent: The higher elevations in the mountains surrounding Mono Lake in east-central California. The soils are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Cowtrack Mountain.

Remarks: Cowtrack soils have an aridic moisture regime that borders on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

COWTRACK VARIANT

Cowtrack Variant soils are very deep and somewhat excessively drained. They formed in ashy alluvium and aerial ash deposits on valley floors and fan terraces. Slopes range from 0 to 9 percent. The mean annual precipitation is 12 to 14 inches, mostly as snow, and the mean annual temperature is about 40°F.

Taxonomic Class: Ashy, frigid Xeric Torripsamments

Typical Pedon: Cowtrack Variant gravelly coarse sand - on a 9 percent northwest slope at 7,750 feet elevation under big sagebrush, needle and thread grass, and antelope bitterbrush vegetation. Colors are for dry soil

unless otherwise stated. When described (6/5/80) the soil was moist below 1 inch.

20 percent of the soil surface is covered with pumice pebbles.

A1--0 to 1 inch; light brownish gray (10YR 6/2) gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 20 percent fine and medium pumice pebbles; slightly acid (pH 6.1); abrupt smooth boundary (1 to 2 inches thick)

A2--1 to 5 inches; light brownish gray (10YR 6/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; 10 percent fine pumice pebbles; neutral (pH 6.7); clear smooth boundary. (4 to 5 inches thick)

C1--5 to 13 inches; light gray (10YR 7/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; 10 percent fine pumice pebbles; neutral (pH 6.9); abrupt wavy boundary. (7 to 15 inches thick)

2C2--13 to 17 inches; light brownish gray (10YR 6/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; 15 percent fine pumice pebbles; neutral (pH 7.1); clear wavy boundary. (3 to 4 inches thick)

2C3--17 to 26 inches; light gray (10YR 7/2) gravelly loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft very friable nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine interstitial pores; 15 percent fine and medium pumice pebbles; mildly alkaline (pH 7.4); abrupt wavy boundary. (8 to 10 inches thick)

3C4--26 to 30 inches; very pale brown (10YR 7/3) gravelly coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 20 percent fine and medium pumice pebbles, mildly alkaline (pH 7.6); abrupt wavy boundary. (4 to 5 inches thick)

3C5--30 to 35 inches; very pale brown (20YR 7/3) gravelly coarse sand brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and few fine interstitial pores; 30 percent fine and medium pumice pebbles; neutral (pH 7.0); abrupt wavy boundary. (5 to 8 inches thick)

4C6--35 to 55 inches; light gray (10YR 7/2) gravelly loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 15 percent fine and medium pumice pebbles; neutral (pH 7.1); clear wavy boundary. (17 to 25 inches thick)

5C7--55 to 65 inches; very pale brown (10YR 7/3) loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 10 percent fine pumice pebbles; mildly alkaline (pH 7.4).

Modal Location: Mono County, California. About 12 miles east-southeast of Lee Vining near Mono Mills; 20 feet east of dirt road, directly across from Jeffrey pine tree on west side of road; in the SW¼SW¼NE¼ Sec. 5, T1S, R28E, M.D.B.M.

Plate 44. Soil profile of Cowtrack Variant soil near the site of Mono Mills (south rim of Mono Basin).

Range in Characteristics: The soil is usually dry from late May to November, and is moist in some or all parts of the control section the rest of the time. The soil temperature is above 5°C from April 15 to December 1, and is above 8°C from April 30 to November 15. Summer thunderstorms occur, but are sporadic and usually do not wet the control section. The mean

annual soil temperature is 42 to 47°F. Mean summer soil temperatures are 60 to 64°F. Dry bulk density is 1.1 to 1.25 g/cc.

The A horizon contains 5 to 20 percent fine and medium pumice pebbles. The organic carbon content is 0.6 to 1.0 percent. Soil structure is massive or weakly granular in the A2 horizon. The soil is slightly acid or neutral.

The C horizon contains 5 to 30 percent fine and medium pumice pebbles. The soil is neutral or mildly alkaline. Some stratification is usually present, but no loamy or very gravelly horizons are present. Clay content is 3 to 6 percent.

Geographic Setting: Cowtrack Variant soils are on nearly level to gently rolling valley floors and fan terraces at elevations of 7,600 to 8,200 feet. Slopes are 0 to 9 percent. The soils are formed in rhyolitic volcanic ash alluvium and aerial deposits. The mean annual precipitation is 12 to 14 inches, mostly as snow. Mean January temperature is about 26°F; mean July temperature is about 57°F. The mean annual temperature is 39 to 41°F. The frost-free season is 75 to 100 days.

Geographically Associated Soils: These are the Brantel(T), Cowtrack(T) and Zono(T) soils. Brantel soils have mesic soil temperature regimes. Cowtrack soils are underlain by hard bedrock at depths of 40 to 60 inches. Cowtrack soils also have loamy horizons between depths of 30 to 60 inches. Zono soils are underlain by hard bedrock at depths of 40 to 60 inches and are mesic.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly big sagebrush, antelope bitterbrush, Indian ricegrass, low sagebrush, basin wildrye, perennial forbs, annual forbs, and Thurbers needlegrass.

Distribution and Extent: Intermountain valleys in east-central California. The soils are of small extent within the inventory area.

CRYOBOROLLS

These soils are shallow to deep, well drained, and have formed in residuum weathered from metasedimentary or metavolcanic rock, or from granitic rock. Slopes are 15 to 50 percent. The mean annual precipitation is 10 to 12 inches and the mean annual temperature is 32 to 37°F.

Reference Pedon: bouldery coarse sandy loam - on a 25 percent southwest slope at 10,120 feet elevation under subalpine big sagebrush, low sagebrush, lupine, rubber rabbitbrush, and buckwheat vegetation. Colors are for dry soil unless otherwise stated. When described (8/14/79) the soil was dry throughout.

The soil is covered with 2 percent boulders, 2 percent stones, 5 percent cobbles, and 10 percent pebbles.

A--0 to 10 inches; grayish brown (10YR 5/2) bouldery coarse sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 2 percent boulders, 2 percent stones, 5 percent cobbles, and 5 percent fine pebbles; neutral (pH 7.0); abrupt wavy boundary.

R--10 inches; hard granitic bedrock.

Location: Inyo County, California. About 7¼ miles east-northeast of Lone Pine and ½ mile southeast of New York Butte; 36° 38' 29" N. Lat., 117° 55' 36" W. Long.

Range in Characteristics: Depth to hard bedrock is 10 to 60 inches. The soil within the moisture control section is usually dry from late May to November, and is moist in some or all parts of the control section the rest of the time. The soil temperarture is above 5°C from June 10 to September 30, and is above 8°C from June 16 to September 20. The mean annual soil temperature is 37 to 43°F, and the mean summer soil temperature is 52 to 59°F. The soil surface is covered with a 40 to 80 percent pavement of angular gravel and cobbles where the parent rock is metamorphic; in granitic areas, the soil is covered with 3 to 15 percent stones and boulders, 5 to 10 percent cobbles and 10 to 20 percent gravel. The soil reaction is slightly acid to mildly alkaline. Base saturation is 50 to 80 percent.

The A horizon has dry color of 10YR 4/2, 5/2, or 5/3, and moist color of 10YR 2/2, 3/2, or 3/3. In areas of metamorphic parent rock, textures are gravelly, very gravelly, or extremely gravelly sandy loam. In areas of granitic parent rock, textures are stony, bouldery, very stony, or very bouldery coarse sandy loam or loamy coarse sand. Rock fragment content in metamorphic areas is 15 to 60 percent and this is mainly angular gravel and cobbles. In granitic areas it is 3 to 50 percent with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent gravel. Organic carbon content is 0.6 to 1.0 percent. Structure is subangular blocky or massive.

The B horizon, where present, usually has higher values and brighter chromas than the A horizon. Textures are sandy loam or sandy clay loam. Rock fragment content is similar to the A horizon.

The C horizon where present has colors and rock fragment content similar to the B horizon. Textures are similar to the A horizon. In granitic areas, a Cr horizon is usually present.

Geographic Setting: These soils occur on high mountain slopes at elevations of 9,600 to 11,100 feet. Slopes are 15 to 50 percent. The soils formed in residuum weathered from granitic or metamorphic rock. The mean annual precipitation is 10 to 12 inches, mostly as winter snowfall, and the mean annual temperature is 32 to 37°F. Total snowfall is estimated at 90 to 120 inches per year. The frost-free season is 10 to 75 days.

Geographically Associated Soils: These are the frigid Haplargids and the frigid Torriorthents at lower elevations. These soils have a frigid soil temperature regime.

Drainage and Permeability: Well drained, medium or rapid runoff; moderately slow to rapid permeability.

Use and Vegetation: Used for wildlife habitat. Vegetation is mainly subalpine big sagebrush, low sagebrush, various high altitude buckwheats, desert bitterbrush, Sandberg bluegrass, perennial forbs and junegrass. Groves of limber pine and bristlecone pine are also present, with the bristlecone pine preferring the areas of calcareous metamorphic rock.

Distribution and Extent: The crest of the Inyo-White Mountains. The soils are of small extent within the inventory area.

DEEPWELL SERIES

The Deepwell series consists of very deep, somewhat excessively drained, soils on aeolian sand dunes. They are on undulating to rolling terrain with slopes of 2 to 15 percent. The mean annual precipitation is 8 to 10 inches, much of it as snow, and the mean annual temperature is about 45°F.

Taxonomic Class: Ashy, mesic Xeric Torripsamments

Typical Pedon: Deepwell sand - on a 3 percent northeast slope at 6,480 feet elevation under sparse rubber rabbitbrush and Indian ricegrass vegetation. Colors are for dry soil unless otherwise stated. When described (8/10/79) the soil was dry throughout.

C1--0 to 3 inches; light gray (10YR 7/1) sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; mildly alkaline (pH 7.6); clear smooth boundary. (2 to 4 inches thick)

C2--3 to 60 inches; light gray (10YR 7/1) sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; mildly alkaline (pH 7.6).

Type Location: Mono County, California. In Adobe Valley about 7 miles NW of Benton and 1 mile NW of Antelope Mountain; 20 feet SW of dirt road on sand dune; in the NE¼ NW¼ SW¼ Sec. 33, T1N, R31E, M.D.B.M.

Range in Characteristics: The ash content ranges from 60 to 100 percent by weight. The soil is usually dry from mid-May to mid- November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to Nov. 30. Summer and fall thunderstorms occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is 47 to 55°F.

The C horizon has dry color of 10YR 6/2, 7/1, 7/2, or 7/3, and moist color of 10YR 4/2, 5/2, or 5/3. Textures are sand or fine sand. The sand particles are poorly graded due to the aeolian origin, and are mostly fine and medium sands. Base saturation is 90 to 100 percent. The soil reaction is neutral to moderately alkaline.

Geographic Setting: Deepwell soils are on stabilized or semi-stabilized sand dunes on basin floors and lake terraces. They have formed in windblown rhyolitic volcanic ash. Slopes are 2 to 15 percent. The elevation range is 6,400 to 7,000 feet. The mean annual precipitation is 8 to 10 inches, much of it as snow, and the mean annual temperature is 43 to 50°F. The mean January temperature is about 30°F; mean July temperature is about 67°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Brantel(T) and Alamedawell(T) soils. Alamedawell soils have loamy lacustrine sediments at depths of 20 to 40 inches. Brantel soils are mostly on alluvial fans and fan terraces, have sands of all size fractions, and have pumice and obsidian gravel.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used for rangeland and wildlife habitat. The vegetation is rubber rabbitbrush, hairy horsebrush, fourwing saltbush, little horsebrush, black greasewood, spiny hopsage, big sagebrush, Indian ricegrass, annual forbs, inland saltgrass, Douglas rabbitbrush, and perennial forbs.

Distribution and Extent: The Mono Lake area in east-central California. The soils are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: Deepwell series is named after Deep Wells Road.

Remarks: Deepwell soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

DOTARD SERIES

Dotard soils are very deep, well drained gravelly soils that formed in alluvium from metasedimentary rocks. They are on moderately to strongly sloping alluvial fans. Slopes are 5 to 15 percent. The mean annual precipitation is 8 to 10 inches, much of it as snow, and the mean annual temperature is 46 to 50°F.

Taxonomic Class: Loamy-skeletal, mixed (calcareous), mesic Xeric Torriorthents

Typical Pedon: Dotard very gravelly sandy loam - on a 9 percent northwest slope at 5,760 feet elevation under big sagebrush and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (9/19/78) the soil was dry throughout.

Surface coverage from rock fragments; less than 1 percent angular stones, 1 percent angular cobbles, and 50 percent angular pebbles.

A1--0 to 1 inch; brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; few very fine vesicular pores; 1 percent angular stones, 1 percent angular cobbles, and 50 percent angular pebbles; slightly acid (pH 6.3); abrupt smooth boundary. (½ to 1 inch thick)

A2--1 to 3 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; common very fine interstitial pores; 5 percent angular cobbles and 10 percent angular pebbles; slightly acid (pH 6.3); clear wavy boundary. (2 to 4 inches thick)

C--3 to 14 inches; very pale brown (10YR 7/4) very cobbly fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and coarse roots; common very fine interstitial pores; 5 percent angular stones, 20 percent angular cobbles, and 20 percent angular pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 7.8); gradual wavy boundary. (8 to 12 inches thick)

Ck--14 to 60 inches; very pale brown (10YR 7/4) very cobbly fine sandy loam, yellowish brown (10YR 5/4) moist; weak; weak fine and medium angular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; 5 percent angular stones, 20 percent angular cobbles, and 30 percent pebbles; violently effervescent, lime disseminated and thin films of carbonates on undersides on rock fragments; moderately alkaline (pH 8.0).

Modal Location: Mono County, California. About 2½ miles southeast of Benton; 10 feet north of dirt road at the northeast corner of S½SW¼SE¼NW¼ Sec. 10, T2S, R32E, M.D.B.M.

Range in Characteristics: These soils are usually dry from early May through November, and are moist in some or all parts of the moisture control section the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 53 to 58°F. The metasedimentary rock fragments tend to be angular in shape.

The A horizon has dry color of 10YR 5/3, or 6/3, and moist color of 10YR 3/3, or 4/3. Rock fragment content ranges from 10 to 50 percent with 0 to 3 percent stones, 0 to 20 percent cobbles, and 10 to 40 percent pebbles. Surface stones are present near the canyon mouths. Textures are gravelly, very gravelly, or stony sandy loam. The organic carbon content ranges from 0.4 to 0.6 percent. The soil reaction is slightly acid or neutral.

The C horizon has dry color of 10YR 7/3 or 7/4, and moist color of 10YR 5/3 or 5/4. Rock fragment content ranges from 35 to 60 percent with 0 to 10 percent stones, 10 to 30 percent cobbles, and 15 to 40 percent pebbles. Textures are very gravelly or very cobbly fine sandy loam. The soil reaction is mildly or moderately alkaline.

Geographic Setting: Dotard soils formed on metasedimentary alluvial fans. Many of these fans are dissected with a few shallow, discontinuous drainages

and washes. Elevations range from 5,400 to 6,700 feet. The mean annual precipitation is 8 to 10 inches, much of it as snow. The mean January temperature is about 32°F; mean July temperature is about 70°F. The mean annual temperature is 46 to 50°F. The frost-free season is 130 to 145 days.

Geographically Associated Soils: These are the Rovana(T), Tuttle(T), and Washoe soils. Rovana soils have a sandy particle-size control section. Tuttle soils have a sandy-skeletal particle-size control section. Washoe soils have argillic horizons.

Drainage and Permeability: Well drained; medium runoff; moderately rapid permeability.

Use and Vegetation: Used principally for grazing and wildlife habitat. Vegetation is mainly big sagebrush, Douglas rabbitbrush, Nevada ephedra, spiny hopsage, longspine horsebrush, galleta grass, desert needlegrass, antelope bitterbrush, annual forbs, perennial forbs, and staghorn cholla,

Distribution and Extent: Alluvial fans in the Owens Valley region of east-central California. The soils are of small extent within the inventory area.

Remarks: The Dotard soils mapped in this inventory are taxadjunct to the Dotard series because they have a higher mean annual soil temperature, longer frost-free season, slightly steeper slopes, and lower elevations. These differences, however, do not greatly affect use and management.

DURARGIDS, SHALLOW

These soils are shallow, well drained, and have formed in alluvium from predominantly granitic rock sources. Slopes are 2 to 9 percent. The mean annual precipitation is 7 to 8 inches and the mean annual temperature is 53 to 55°F.

Reference Pedon: loamy coarse sand - on a 7 percent northeast slope at 4,710 feet elevation under blackbrush, white burrobush, Cooper golden- bush, Nevada ephedra, and spiny hopsage vegetation. Colors are for dry soil unless otherwise stated. When described (6/79) the soil was dry throughout.

The soil surface is covered with 2 percent stones, 3 percent cobbles, and 10 percent fine pebbles.

A1--0 to 2 inches; pale brown (10YR 6/3) loamy coarse sand, dark grayish brown (10YR 4/2) moist; moderate coarse and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores; 2 percent stones, 3 percent cobbles, and 5 percent fine pebbles; mildly alkaline (pH 7.6); abrupt smooth boundary.

A2--2 to 5 inches; pale brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; many very fine

vesicular and common very fine tubular pores; 2 percent stones, 3 percent cobbles, and 5 percent fine pebbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

Bt1--5 to 19 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure breaking to strong coarse angular blocky structure; very hard, friable, very sticky and very plastic; common very fine roots; common very fine tubular pores; continuous moderately thick clay films on peds, in pores, and bridging mineral grains; 5 percent fine pebbles; mildly alkaline (pH 7.5); gradual smooth boundary.

Cqm--19 to 54 inches; brown (7.5YR 5/4) silica cemented duripan, dark brown (7.5YR 4/4) moist; massive; very hard, very firm; few very fine tubular pores; many moderately thick opalized clay films in pores and bridging mineral grains; diffuse smooth boundary.

C--54 to 61 inches; brown (10YR 6/3) sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 5 percent fine pebbles; mildly alkaline (pH 7.5).

Location: Inyo County, California. About 3½ miles southwest of Bishop, 20 feet north of power line road; in the NW¼SW¼NE¼ Sec. 22, T7S, R32E, M.D.B.M.

Range in Characteristics: Depth to the duripan is 10 to 20 inches. These soils, between depths of 9 to 20 inches, are usually dry from late April through November, and are moist in some part the rest of the time. The soil temperature is above 8°C from about March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 61°F. The surface rock fragment coverage ranges from 10 to 35 percent with 1 to 3 percent boulders and stones, 1 to 10 percent cobbles, and 20 to 40 percent gravel. The soil reaction is neutral to mildly alkaline.

The A horizon has dry color of 10YR 6/3 and moist color of 10YR 4/2 or 4/3. Textures are loamy coarse sand, gravelly loamy coarse sand, sandy loam, or gravelly sandy loam. The sandy loam textures represent a subsurface vesicular layer (A2 horizon). Rock fragment content ranges form 5 to 35 percent: 0 to 3 percent boulders and stones, 0 to 10 percent cobbles, and 5 to 25 percent gravel (mostly fine gravel). The organic carbon content is 0.2 to 0.5 percent.

The B horizon has dry color of 7.5YR 5/4, 10YR 5/4, or 5/6, and moist color of 7.5YR 4/4, 10YR 4/4, or 4/6. Textures above the duripan are clay, clay loam, sandy clay loam, or sandy loam. Clay content ranges from 30 to 60 percent. Structure is prismatic and/or angular blocky. The duripan consists of the lower B horizon which has become indurated. It varies in consistence from hard to very hard. Many pedons cannot be excavated beyond the duripan, even with a backhoe.

The C horizon has textures of sand or loamy coarse sand.

Geographic Setting: These soils occur on dissected remnants of old alluvial fans of the Sierra Nevada and Benton Range at elevations of 4,200 to 5,300 feet. Slopes are 2 to 9 percent. The soils formed in alluvium from predominantly granitic rock sources, with some basaltic alluvium present.

The mean annual precipitation is 7 to 8 inches and the mean annual temperature is 53 to 55°F. The frost-free season is 150 to 175 days.

Geographically Associated Soils: These are the Lubkin(T), Pajuela, Thibau(T), and Tinemaha(T) soils. These soils lack a duripan. Lubkin soils have coarse-loamy argillic horizons. Pajuela soils have sandy-skeletal particle-size control sections. Thibau soils are sandy. Tinemaha soils have loamy-skeletal argillic horizons.

Plate 45. Soil profile of a shallow Durargid soil about 3½ miles southwest of Bishop. The backhoe was able to dig only several inches into the hardpan (note grooves in hardpan from the backhoe teeth). A claypan is present above the hardpan, at a depth of 5 to 19 inches.

Drainage and Permeability: Well drained; medium runoff; very slow permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly blackbrush, white burrobush, needleleaf rabbitbrush, Cooper goldenbush, Nevada ephedra, spiny hopsage, desert needlegrass, annual forbs, and Indian ricegrass.

Distribution and Extent: Remnants of old alluvial fans of the Sierra Nevada and Benton Range in Inyo and Mono counties, California. The soils are of small extent within the inventory area.

DURORTHIDS, ASHY

These soils are very shallow to moderately deep, well to somewhat excessively drained, and have formed in ashy beach deposits. Slopes are 0 to 2 percent. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F.

Reference Pedon: sand - on a 1 percent northwest slope at 6,400 feet elevation under inland saltgrass vegetation. Colors are for dry soil unless otherwise noted. When described (7/77) the soil was dry throughout.

A--0 to 4 inches; light gray (10YR 7/2) sand, light gray (10YR 6/2) moist; single grain; loose, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; 5 percent fine pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

C--4 to 10 inches; light yellowish brown (10YR 6/4) gravelly coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; 25 percent fine pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

Ckqm--10 inches; extremely hard lime-silica duripan.

Location: Mono County, California. About 8 miles east of Lee Vining on the shore of Mono Lake; in the SW¼NE¼NE¼ Sec. 15, T1N, R27E, M.D.B.M.

Range in Characteristics: Depth to the duripan ranges from 1 to 40 inches. The soil above the pan is usually dry from mid-May to November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thunderstorms occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is about 50°F. The soil is mildly to moderately alkaline.

The A horizon has dry color of 10YR 6/1, 7/1, or 7/2, and moist color of 10YR 4/1, 5/1, or 5/2. Textures are sand, loamy sand, or gravelly coarse sand. Gravel content ranges from 5 to 30 percent. Gravel-sized tufa fragments are present in some pedons. The fine-earth fraction is ashy.

The C horizon has dry color of 10YR 6/2, 6/4, 7/2, 7.5YR 7/1, or 5Y 7/3, and moist color of 10YR 4/2, 4/4, 5/2, 7.5YR 5/1, or 5Y 4/3. Textures are sand, loamy sand, gravelly sand, coarse sand, or gravelly coarse sand. Stratification is usually present. Gravel content ranges from 0 to 35 percent. Gravel-sized tufa fragments are present in some pedons. The fine-earth fraction is ashy. The pan is very hard or extremely hard. Its structure is typically very coarse platy.

Geographic Setting: These soils occur on the shoreline of Mono Lake at elevations of 6,300 to 6,500 feet. Slopes are 0 to 2 percent, with a hummocky surface in some areas. The soils formed in rhyolitic ashy alluvium (beach deposits) and airfall ash deposits. The pan may be a result of shallow ground

water evaporation associated with groundwater spring activity near the lakeshore. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Brantel(T) soils and the Xeric Torriorthents ashy, Xeric Torriorthents sodic, Aquents, and Aquic Torriorthents. Brantel soils are sandy throughout the textural control section and lack a duripan.

Drainage and Permeability: Somewhat poorly to somewhat excessively drained; slow or very slow runoff; rapid or very rapid permeability above the duripan, very slow permeability through the duripan.

Use and Vegetation: Used for wildlife habitat and recreation. Vegetation is sparse inland saltgrass with scattered rubber rabbitbrush and Russian thistle in some areas.

Distribution and Extent: Lakeshore areas in Mono County, California. The soils are of small extent within the inventory area.

ENTIC DURORTHIDS

These soils are shallow or moderately deep, well drained, and have formed in alluvium from mixed rock sources. Slopes are 15 to 50 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F.

Reference Pedon: extremely gravelly sandy loam - on an 8 percent southeast slope at 4,700 feet elevation under shadscale and Fremont dalea vegetation. Colors are for dry soil unless otherwise stated. When described (9/30/77) the soil was dry throughout.

The soil surface is paved with three percent cobbles and 80 percent angular pebbles.

A1--0 to 1 inch; light gray (2.5Y 7/2) extremely gravelly sandy loam, light olive brown (2.5Y 5/4) moist; weak fine platy structure; soft, friable, nonsticky and nonplastic; few very fine vesicular pores; 3 percent angular cobbles and 80 percent angular gravel; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--1 to 4 inches; light gray (2.5Y 7/2) gravelly sandy loam, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and common fine vesicular pores; five percent angular cobbles and 20 percent angular pebbles; thin coatings of lime-silica on undersides of rock fragments; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

Ckq1--4 to 11 inches; light gray (2.5Y 7/2) very gravelly sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine interstitial pores; 10 percent angular cobbles and 45 percent angular pebbles; 1cm pendants of lime-silica on undersides of rock fragments, in some spots forming a continuous matrix; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); clear wavy boundary.

Ckq2--11 to 18 inches; white (10YR 8/1) weakly cemented lime-silica duripan; can be dug with hand tools; extremely hard in spots where opal layers form a 2mm-1cm lense around rock fragments; roots penetrate the pan in the weaker areas; 10 percent angular cobbles and 45 percent angular pebbles.

Ckq3--18 to 40 inches; light gray (2.5Y 7/2) extremely gravelly sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, firm, slightly sticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 1cm pendants of lime-silica on undersides of rock fragments, forming continuous lenses in some spots; 15 percent angular cobbles and 45 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt wavy boundary.

Ck--40 to 60 inches, light gray (2.5Y 7/2) extremely gravelly loamy sand, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine

interstitial pores; 1-2mm pendants of lime on undersides of rock fragments; 15 percent angular cobbles and 45 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0).

Location: Inyo County, California. About two miles east of Laws, near Bishop; 30 feet south of dirt road on small plateau area just east of short steep part of dirt road; in the NW¼NW¼NW¼ Sec. 25, T6S, R33E, M.D.B.M.

Range in Characteristics: Depth to the duripan is 10 to 40 inches. These soils (above the duripan) are dry from early April through November, and are intermittently moist in some part of the control section the rest of the time. The control section is not moist fro as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 65°F. The soils have a well developed surface pavement that covers 50 to 80 percent of the soil surface. Surface stone coverage is 0 to 3 percent.

The A horizon has dry color of 10YR 7/2, 7/3, 8/2, or 2.5Y 7/2, and moist color of 10YR 5/3, 5/4, 2.5Y 5/4, or 6/4. Textures are very gravelly or extremely gravelly sandy loam, gravelly sandy loam, or cobbly sandy loam. Rock fragment content is 15 to 80 percent consisting of angular cobbles and angular gravel. A vesicular layer is usually present below the surface pavement. The electrical conductivity is less than 1 mmho/cm and the exchangeable sodium percentage ranges from 1 to 3.

The C horizon has dry color of 10YR 7/2, 7/3, 7/4, 8/1, or 2.5Y 7/2, and moist color of 10YR 5/2, 5/3, 5/4, 7/1, or 2.5Y 5/4. Textures are very gravelly sandy loam, extremely gravelly sandy loam, very gravelly loamy sand, or extremely gravelly loamy sand. Rock fragment content is 35 to 70 percent: 0

to 3 percent angular stones, 5 to 20 percent angular cobbles, and 30 to 60 percent angular gravel. A noncemented C1 horizon is present above the duripan in pedons where the duripan is 20 to 40 inches deep. The salt and sodium content of the upper C horizon is similar to the A horizon. The lower C horizon below a depth of about 40 inches has an electrical conductivity of 1 to 4 mmhos/cm and an exchangeable sodium percentage of 3 to 10. The soil contains up to 1 ppm boron.

Geographic Setting: These soils occur on dissected remnants of fan terraces at the base of the White-Inyo Mountains. They occur predominantly on side-slopes of the dissected terraces. Elevations range from 3,900 to 5,700 feet. The soils formed in gravelly alluvium from mixed rock sources, with metasedimentary alluvium being the primary component. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Typic Durorthids and Yermo soils. The Typic Durorthids have a hard, shallow duripan. Yermo soils are very deep alluvial soils that do not have a duripan.

Drainage and Permeability: Well drained; medium runoff; moderately slow to slow permeability.

Use and Vegetation: Used for limited grazing, recreation (off-road vehicle), and wildlife habitat. Vegetation is mainly shadscale, allscale saltbush, Fremont dalea, white burrobush, bud sagebrush, desert needlegrass, desert trumpet, and Indian ricegrass. Creosotebush grows in the warmer areas (south of Independence).

Distribution and Extent: Terrace remnants of old alluvial fans at the base of the White-Inyo Mountains in Inyo and Mono Counties, California. The soils are of small extent within the inventory area.

GARLOCK VARIANT

Garlock Variant soils are very deep, well drained soils that formed in granitic alluvium. Garlock soils are on gently to strongly sloping bouldery alluvial fans and fan terraces. The mean annual precipitation is 4 to 6 inches, and the mean annual temperature is 55 to 59°F.

Taxonomic Class: Fine-loamy, mixed, thermic Typic Haplargids

Typical Pedon: Garlock Variant gravelly loamy coarse sand - on a 9 percent east slope at 4,080 feet elevation under white bursage, allscale saltbush, bud sagebrush, spiny hopsage, and longspine horsebrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/77) the soil was dry throughout.

Surface coverage of rock fragments: 2 percent stones, 1 percent cobbles, and 15 percent fine pebbles; ¼ inch platy surface crust.

A1--0 to 2 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 2 percent stones, 1 percent cobbles, and 15 percent pebbles; moderately alkaline (pH 8.0); clear smooth boundary. (0 to 3 inches thick)

A2--2 to 6 inches; brownish yellow (10YR 6/6) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores; 2 percent stones; 5 percent cobbles, 15 percent pebbles; moderately alkaline (pH 8.0); abrupt wavy boundary. (3 to 20 inches thick)

Bt1--6 to 20 inches; reddish yellow (7.5YR 6/6) gravelly sandy clay loam, strong brown (7.5YR 5/6) moist; strong medium and coarse angular blocky structure; very hard, friable, slightly sticky and plastic; few very fine and fine roots; few very fine interstitial and tubular pores; common moderately thick clay films in pores, on peds, and bridging sand grains; 5 percent stones, 5 percent cobbles, and 15 percent pebbles; moderately alkaline (pH 8.0); gradual wavy boundary. (15 to 30 inches thick)

Bt2--20 to 27 inches; reddish yellow (10YR 6/6) gravelly sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine interstitial and tubular pores; few moderately thick clay films in pores and on peds; few thin clay films bridging sand grains; 5 percent stones; 5 percent cobbles, and 15 percent pebbles; moderately alkaline (pH 8.0); gradual wavy boundary. (0 to 14 inches thick)

C--27 to 60 inches; reddish yellow (7.5YR 6/6) stony sandy loam, strong brown (7.5YR 5/6) moist; massive; hard, friable, slightly sticky and nonplastic; few very fine roots; common very fine interstitial pores; 10 percent stones, 5 percent cobbles; and 15 percent pebbles; moderately alkaline (pH 8.0).

Modal Location: Inyo County, California. About 6¼ miles south of Lone Pine and 1 mile west of Hwy. 395, in the Owens Valley; southeast facing roadcut about 400 feet northeast of sharp bend in dirt powerline road; at the NW corner of the NE¼ SE¼ SW¼, Sec. 27, T16S, R36E, M.D.B.M.

Range in Characteristics: These soils are usually dry from early April through November, and are intermittently moist in some part of the moisture control section the rest of the time. The control section is not moist for as long as 90 consecutive days in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 64°F. Rock fragments tend to be rounded or have rounded edges. Some profiles are calcareous with weakly effervescent disseminated lime. The surface rock fragment coverage ranges from 10 to 30 percent consisting of 0 to 3 percent stones and boulders, 0 to 10 percent cobbles, and 10 to 20 percent gravel. The soil is moderately alkaline.

The A horizon has dry color of 10YR 6/3, 6/4, 7/3, or 7/4 and moist color of 10YR 4/3, 4/4, 5/3, or 5/4. Rock fragment content ranges from 15 to 30 percent with 0 to 3 percent stones and boulders, 0 to 10 percent cobbles,

and 5 to 20 percent gravel. Textures are gravelly loamy coarse sand or gravelly sandy loam. The organic carbon content is 0.2 to 0.3 percent. The B horizon has dry color of 10YR 6/4, 6/6, or 7.5YR 6/6, and moist color of 10YR 5/4, 5/6 or 7.5YR 5/6. Rock fragment content is 15 to 35 percent with 0 to 15 percent stones or boulders, 0 to 20 percent cobbles, and 5 to 20 percent gravel. Textures are gravelly sandy loam or gravelly sandy clay loam. Clay films are thin to moderately thick. Clay content is 18 to 30 percent.

The C horizon has dry color of 10YR 6/4, 6/6, 7/6, or 7.5YR 6/6, and moist color of 10YR 4/4, 4/6, 5/6, or 7.5YR 5/6. Rock fragment content ranges from 15 to 35 percent with 0 to 20 percent stones or boulders, 0 to 25 percent cobbles, and 5 to 25 percent gravel. Textures are loamy coarse sand or sandy loam with or without gravelly, cobbly, or stony modifiers. Segregated lime occurs in seams and in soft masses in some pedons.

Geographic Setting: Garlock Variant soils formed on older alluvial fans and fan terraces. These alluvial fans and fan terraces form long aprons along mountain range fronts. They are dissected with some drainageways and shallow washes. Slopes are 2 to 9 percent. Elevations range from 3,700 to 4,500 feet. The mean annual precipitation is 4 to 6 inches. The mean January temperature is about 39°F; mean July temperature is about 79°F; mean annual temperature is 55 to 59°F. The frost-free season is 200 to 225 days.

Geographically Associated Soils: These are the Bitter, Arizo, Cajon, and Yellowrock soils. The Arizo, Cajon, and Yellowrock soils lack argillic horizons. Arizo soils have sandy-skeletal control sections. Cajon and Yellowrock soils have sandy control sections. Bitter soils have loamy-skeletal control sections.

Drainage and Permeability: Well drained; slow runoff; moderately slow permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly white bursage, shadscale, allscale saltbush, fourwing saltbush, Cooper goldenbush, and bud sagebrush with some Nevada ephedra, white burrobush, spiny hopsage, longspine horsebrush, needleleaf rabbit-brush, common winterfat, California buckwheat, creosotebush, and blackbrush.

Distribution and Extent: Terrace remnants of old alluvial fans at the base of the White-Inyo Mountains in Inyo and Mono Counties, California. The soils are of small extent within the inventory area.

GLENBROOK FAMILY

The Glenbrook family consists of shallow, somewhat excessively drained sandy soils. These soils are on steep hillsides bordering Owens Valley. Slopes are 30 to 50 percent. The mean annual precipitation is 10 to 12 inches, much of it as snow, and the mean annual temperature is about 50°F.

Taxonomic Class: Mixed, mesic, shallow Xeric Torripsamments

Reference Pedon: Glenbrook family bouldery loamy coarse sand - on a 48 percent southwest slope at 6,400 feet elevation under green Mormon-tea, desert bitterbrush, and singleleaf pinyon pine vegetation. Colors are for dry soil unless otherwise stated. When described (6/79) the soil was dry throughout.

The soil surface is covered with 10 percent boulders, 2 percent stones, 1 percent cobbles, and 20 percent fine pebbles.

A1--0 to 2 inches; grayish brown (10YR 5/2) bouldery loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 5 percent boulders, 2 percent stones, 1 percent cobbles, and 20 percent fine pebbles; neutral (pH 7.2); abrupt smooth boundary.

A2--2 to 11 inches; grayish brown (10YR 5/2) bouldery loamy coarse sand, very dark grayish brown (10YR 3/2) moist; massive parting to single grain; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 5 percent boulders, 2 percent stones and 20 percent fine pebbles; mildly alkaline (pH 7.5); clear irregular boundary.

Cr--11 inches; pale brown (10YR 6/3) decomposing granitic bedrock; retains rock structure; diggable with spade; few very fine and fine roots.

Location: Inyo county, California. About 6 miles southwest of Lone Pine on the Sierra Nevada escarpment; 50 feet west of dirt road just before sharp turn at Tuttle Creek; in the NE¼SW¼NE¼ Sec. 9, T16S, R35E, M.D.B.M.

Range in Characteristics: Depth to the paralithic contact is 10 to 20 inches. The soil above the contact is usually dry from early May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 55 to 58°F.

The A horizon has dry color of 10YR 5/2, 6/2, or 6/3, and moist color of 10YR 3/2, 3/3, or 4/3. Textures are bouldery, stony, or gravelly loamy coarse sand. Rock fragment content is 5 to 30 percent consisting of 0 to 10 percent boulders, 0 to 10 percent stones, 0 to 5 percent cobbles, and 5 to 30 percent gravel. The organic carbon content is 0.3 to 0.6 percent.

Geographic Setting: These soils occur on steep hillsides with slopes of 30 to 50 percent. The soils formed in residuum weathered from granitic rocks. The elevation range is 5,600 to 8,000 feet. The mean annual precipitation is 10 to 12 inches, much of it as snow, and the mean annual temperature is 42 to 52°F. The mean January temperature is about32°F; the mean July temperature is about 70°F. The frost-free season is 110 to 150 days.

Geographically Associated Soils: These are the Berent family soils. Berent family soils are moderately deep to very deep.

Drainage and Permeability: Somewhat excessively drained; medium runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of big sagebrush, desert bitterbrush, Douglas rabbitbrush, Dorr's

sage, Nevada ephedra, desert needlegrass, common winterfat, green Mormon tea, singleleaf pinyon, and annual forbs.

Distribution and Extent: Escarpment of the Sierra Nevada and White Mountains in east-central California. The soils are of small extent within the inventory area.

HAAR FAMILY

The Haar family consists of shallow and very shallow, well drained soils. These are on mountain plateaus and hillsides with slopes of 2 to 15 percent. The mean annual precipitation is 7 to 10 inches and the mean annual temperature is 48 to 53°F.

Taxonomic Class: Loamy, mixed, nonacid, mesic, shallow Xeric Torriorthents

Reference Pedon: Harr family gravelly loamy sand - on a 12 percent northeast slope at 5,550 feet elevation under big sagebrush and desert bitterbrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/20/79) the soil was dry throughout.

25 percent of the soil surface is covered with pebbles.

A1--0 to 2 inches; pale brown (10YR 6/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky, and nonplastic; few very fine roots; many very fine interstitial pores; 15 percent fine pebbles; slightly acid (pH 6.4); abrupt smooth boundary.

A2--2 to 5 inches; pale brown (10YR 6/3) coarse sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine roots; many very fine and fine vesicular pores; 5 percent pebbles; neutral (pH 6.7); abrupt smooth boundary.

Cr--5 inches; decomposing granodiorite bedrock; diggable with spade.

Location: Inyo County, California; about 8 miles west of Bishop in the Tungsten Hills; 30 feet south of the dirt road; in the NW¼NW¼SE¼ Sec. 2, T7S, R31E, M.D.B.M.

Range in Characteristics: Depth to decomposing granitic bedrock is 4 to 20 inches. The soil is usually dry from early May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 51 to 59°F.

The A horizon has dry color of 10YR 5/3, 6/2, 6/3, 6/4, or 7/3, and moist color of 10YR 3/3, 4/2, 4/3, 4/4, or 5/3. It is loamy coarse sand or gravelly loamy coarse sand on the surface. The organic carbon content is 0.2 to 0.6 percent. Structure is usually single grain over massive, or weak subangular blocky structure in some profiles. Gravel content is 5 to 20 percent. Most of the gravel is 2mm to 1cm in diameter. Stone plus boulder content ranges

from 0 to 3 percent. Clay content is 5 to 12 percent. The particle size control section averages coarse sandy loam. The base saturation is 90 to 100 percent.

Geographic Setting: These soils are on mountain plateaus and hillsides at elevations of 4,800 to 7,000 feet. The topography is undulating to steep with slopes of 2 to 15 percent. The soils formed in residuum weathered from granitic rocks. The mean annual precipitation is 7 to 10 inches, some as snow, and the mean annual temperature is 48 to 53°F. The mean January temperature is about 34°F; the mean July temperature is about 72°F. The frost-free season is 100 to 160 days. Rock outcrops are usually associated with these soils.

Plate 46. Soil profile of a Haar family soil, west of Big Pine on the Warren Bench. Note the shallow granitic bedrock.

Geographically Associated Soils: These are the Buscones(T) and Sherwin(T) soils. Buscones soils are moderately deep over soft rhyolitic tuff. Sherwin soils are shallow over hard tuff.

Drainage and Permeability: Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly big sagebrush, desert bitterbrush, needleleaf rabbitbrush, Indian ricegrass, bottlebrush squirreltail, Nevada ephedra, blackbrush, desert needlegrass, spiny hopsage, and annual forbs.

Distribution and Extent: Mountain areas of eastern California. The soils are of small extent within the inventory area.

Halloran Variant soils are deep, well drained soils that are saline-sodic. They formed in mixed alluvium on old fan terraces near Owens Lake. Slopes are 2 to 5 percent. The mean annual precipitation is about 4 inches and the mean annual temperature is about 59°F.

Taxonomic Class: Coarse-loamy, mixed, thermic Typic Natrargids

Typic Pedon: Halloran Variant very gravelly sand - on a 2 percent northwest slope at 3,720 feet elevation under Mojave seablite, allscale saltbush, and shadscale vegetation. Colors are for dry soil unless otherwise stated. When described (6/26/79) the soil was dry throughout.

50 percent of the soil surface is covered with a pavement of pebbles.

A1--0 to 1 inch; light gray (10YR 7/2) very gravelly sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic, many very fine interstitial pores; 50 percent pebbles; violently effervescent, lime disseminated; very strongly alkaline (pH 9.4); abrupt smooth boundary. (½ to 1 inch thick)

A2--1 to 8 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak coarse platy structure parting to moderate coarse and medium subangular blocks; hard friable, slightly sticky and nonplastic; few very fine roots; many very fine vesicular pores; 5 percent pebbles, 1 percent cobbles; violently effervescent, lime disseminated; very strongly alkaline (pH 10.1); clear smooth boundary. (5 to 8 inches thick)

Btn--8 to 23 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; moderate coarse subangular blocky structure; extremely hard, friable, slightly sticky and nonplastic; few very fine roots; common very fine tubular pores; continuous thin clay films as bridges and common moderately thick and thick clay films on peds, in pores, and as bridges; 5 percent pebbles; violently effervescent, lime disseminated; very strongly alkaline (pH 9.3); gradual wavy boundary. (15 to 18 inches thick)

2C--23 to 41 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 10 percent pebbles; violently effervescent, lime disseminated; very strongly alkaline (pH 9.5); abrupt wavy boundary. (17 to 36 inches thick)

3Ckqm--41 inches; light gray (10YR 7/3) lime-silica duripan; massive; extremely hard, extremely firm; 30 percent pebbles.

Modal Location: Inyo County, California. About 5 miles south-southeast of Keeler on the southeast rim of Owens Lake; 75 feet northwest of Keeler-Olancha Road; 36° 25' 18" N. Lat., 117° 50' 7" W. Long.

Range in Characteristics: Depth to the natric horizon is 5 to 9 inches. Depth to the duripan is 40 to 60 inches. The moisture control section is usually dry from early April through November, and is intermittently moist

in some part of the moisture control section the rest of the time. The control section is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is about 66°F. Some cobbles are present on the soil surface and a surface pavement (mostly gravel) covers 40 to 60 percent of the soil surface.

The A horizon has dry color or 10YR 6/3, 7/2, or 7/3, and moist color of 10YR 4/3, 5/2, or 5/3. The A2 horizon contains 5 to 15 percent rock fragments consisting of 1 to 10 percent gravel and 1 to 5 percent cobbles. The electrical conductivity ranges from 4 to 12 mmhos/cm, and the exchangeable sodium percentage ranges from 50 to 100 percent. The boron content is 40 to 130 ppm of soil.

The Bt horizon has dry color of 10YR 6/3, or 6/4, and moist color of 10YR 4/3 or 4/4. Gravel content is 5 to 10 percent. Electrical conductivity is 4 to 8 mmhos/cm. Exchangeable sodium percentage is 50 to 100, and boron content is 1 to 5 ppm of soil.

The C horizon has dry color of 10YR 6/3, 7/2, or 7/3, and moist color of 10YR 4/3, 5/2, or 5/3. Textures are loamy sand or gravelly loamy sand. Gravel content is 5 to 35 percent. Electrical conductivity is 2 to 6 mmhos/cm. Exchangeable sodium percentage is 20 to 50, and boron content is 1 to 15 ppm of soil.

Geographic Setting: Halloran Variant soils are on gently sloping fan terraces. They formed in mixed alluvium at elevations of 3,600 to 3,800 feet. Slopes range from 2 to 5 percent. The mean annual precipitation is about 4 inches and the mean annual temperature is about 59°F. The mean January temperature is about 41°F; the mean July temperature is about 82°F. The frost-free season is about 225 days.

Geographically Associated Soils: These are the Yellowrock(T) and Yermo soils. Yellowrock soils are sandy and do not have diagnostic subhorizons. Yermo soils contain more than 35 percent rock fragments.

Drainage and Permeability: Well drained; slow runoff; moderate permeability.

Use and Vegetation: At present, used for wildlife habitat. The vegetation is alkali tolerant plants consisting of shadscale, Mojave seablite, allscale saltbush, Parry saltbush, black greasewood, inland saltgrass, annual forbs, and Indian ricegrass.

Distribution and Extent: Halloran Variant soils occur in southern Owens Valley, in southeastern California. They are of small extent within the inventory area.

HAMMIL SERIES

The Hammil series consists of very deep, somewhat excessively drained soils that formed in ashy alluvium. Hammil soils are on nearly level to gently sloping valley floors with slopes of 0 to 5 percent. The mean annual precipitation is 6 to 8 inches and the mean annual temperature is 53 to 55°F.

Taxonomic Class: Ashy, thermic Xeric Torripsamments

Typical Pedon: Hammil gravelly loamy sand - on a 2 percent east slope at 4,800 feet elevation under Nevada dalea, fourwing saltbush, and Russian thistle vegetation. Colors are for dry soil unless otherwise stated. When described (8/12/79) the soil was dry throughout.

A1--0 to ½ inch; very pale brown (10YR 7/3) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, and nonplastic; many very fine interstitial pores; 30 percent fine and medium pumice pebbles; moderately alkaline (pH 7.6); clear smooth boundary. (½ to 1 inch thick)

A2--½ to 3 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 10 percent fine pumice pebbles; moderately alkaline (pH 7.6); clear smooth boundary. (2 to 3 inches thick)

C--3 to 60 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; massive parting to single grain; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores; 10 percent fine pumice pebbles; moderately alkaline (pH 7.6).

Type Location: Mono County, California. About 1.75 miles west of Hammil, 30 feet west of dirt road in the NW¼SW¼SE¼ Sec. 15, T3S, R33 E, M.D.B.M.

Range in Characteristics: The soil between depths of 10 and 40 inches is usually dry from the end of April through November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 60°F. Ash content is 60 to 90 percent. The dry bulk density ranges from 1.1 to 1.25 g/cc and the moist bulk density is 1.3 to 1.45 g/cc. Soil reaction is neutral to mildly alkaline.

The A horizon has dry color of 10YR 6/3, 7/2, or 7/3, and moist color of 10YR 4/3, 5/2, or 5/3. Up to 2 percent cobbles are present in some pedons. The A1 horizon contains 15 to 30 percent pumice gravel and the A2 horizon contains 0 to 10 percent pumice gravel.

The C horizon has colors similar to the A horizon. Textures are loamy sand or gravelly loamy sand with 10 to 25 percent pumice gravel. Up to 2 percent cobbles are present in some pedons. Stratification is present in some pedons, but there are no very gravelly or loamy lenses.

Geographic Setting: Hammil soils are in nearly level to gently sloping valleys near upland volcanic formations. The parent material is predominantly rhyolitic ash alluvium, with granitic and metamorphic influence in some areas.

The elevation range is 4,300 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is 53 to 55°F. The mean January temperature is about 37°F; the mean July temperature is about 76°F. The frost-free season is about 150 days.

Geographically Associated Soils: These are the Chidago(T) and Honova(T) soils. Chidago soils have soft rhyolitic tuff at depths of 20 to 40 inches. Honova soils are shallow over hard tuff.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: At present, used for grazing and wildlife habitat. The vegetation is mainly Nevada dalea, fourwing saltbush, Nevada ephedra, common winterfat, spiny hopsage, Fremont dalea, longspine horsebrush, Indian ricegrass, desert needlegrass, annual forbs, bud sagebrush, and shadscale. Russian thistle tends to invade disturbed areas.

Distribution and Extent: Hammil soils occur near volcanic formations in east-central California. They are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Hammil Valley.

Remarks: Hammil soils have an aridic moisture regime that borders on xeric.

HAPLARGIDS, FRIGID

These soils are shallow to deep, well drained, and have formed in residuum weathered from metasedimentary and metavolcanic rock, or from granitic rock. Slopes are 15 to 50 percent. The mean annual precipitation is 9 to 12 inches and the mean annual temperature is 38 to 43°F.

Reference Pedon: extremely gravelly sandy loam - on a 25 percent northwest slope at 9,100 feet elevation under big sagebrush, California buckwheat, and green Mormon-tea vegetation. Colors are for dry soil unless otherwise stated. When described (7/78) the soil was dry throughout.

The soil is covered with 15 percent angular cobbles and 60 percent angular pebbles.

A1--0 to ½ inch; very pale brown (10YR 7/3) extremely gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; few very fine vesicular pores; 15 percent angular cobbles and 60 percent angular pebbles; strongly effervescent, lime disseminated, mildly alkaline (pH 7.5); abrupt smooth boundary.

A2--½ to 2 inches; very pale brown (10YR 7/3) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, friable, nonsticky, and nonplastic; common very fine roots; many very fine vesicular pores; 5 percent angular cobbles and 25 percent angular pebbles; strongly effervescent, lime disseminated; mildly alkaline (pH 7.5); abrupt smooth boundary.

Bt1--2 to 6 inches; pale brown (10YR 6/3) light sandy clay loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine interstitial pores; common thin clay films bridge mineral grains; 5 percent angular cobbles and 45 percent angular pebbles; thin spotty lime pendants on undersides of rock fragments; strongly effervescent, lime disseminated and segregated in common fine soft masses; moderately alkaline (pH 8.0); clear wavy boundary.

Bt2--6 to 13 inches; very pale brown (10YR 7/3) very gravelly heavy sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine interstitial pores; common thin clay films bridge mineral grains; 5 percent angular cobbles and 50 percent angular pebbles; 1 to 3mm thick lime pendants on undersides of many rock fragments; strongly effervescent, lime disseminated and segregated in common fine soft masses; moderately alkaline (pH 8.0); abrupt irregular boundary.

R--13 inches; highly fractured Permian marine slate.

Location: Inyo County, California. About 8¼ miles northeast of Lone Pine and 3/4 miles west of Keynot Peak; near a saddle at the eastern edge of a stand of trees on a short north slope; 36° 42' 25" N. Lat., 117° 58' 2" W. Long.

Range in Characteristics: Depth to hard bedrock is 10 to 60 inches. The soil within the moisture control section is usually dry from late May to November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 15 to December 1, and is above 8°C from April 30 to November 15. The mean annual soil temperature is 43 to 47°F. Mean summer soil temperatures are 59 to 64°F. The soil surface is covered with a 40 to 80 percent pavement or angular gravel and cobbles where the parent rock is metamorphic, or, in granitic areas, the soil is covered with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent fine gravel. Pedons in granitic areas do not contain lime.

The A horizon has dry color of 10YR 5/2, 6/2, 6/3, 6/4, or 7/3, and moist color of 10YR 3/2, 3/3, 4/2, 4/3, 4/4, or 5/4. In areas of metamorphic parent rock, textures are gravelly, very gravelly or extremely gravelly sandy loam. In areas of granitic parent rock, textures are stony, bouldery, very stony or very bouldery coarse sandy loam or loamy coarse sand. Rock fragment content in metamorphic areas is 15 to 60 percent and this is mainly angular gravel and cobbles. In granitic areas it is 15 to 60 percent with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent fine gravel. Organic carbon content is estimated at 0.4 to 0.6 percent.

The B horizon has dry color of 10YR 6/3, 6/4, 7/3, 7/4, or 7.5YR 6/6, and moist color of 10YR 4/3, 4/4, 5/3, 7.5YR 4/4, or 4/6. In areas of metamorphic parent rock textures are very gravelly or gravelly, sandy clay loam or heavy sandy loam. In areas of granitic parent rock, textures are stony, very stony, or very bouldery sandy clay loam. Rock fragment content in metamorphic areas is 15 to 60 percent and this is mainly angular gravel and cobbles. In granitic areas it is 15 to 60 percent with 10 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent fine gravel.

In some pedons, a C horizon is present above the R horizon, and in granitic areas a Cr horizon is present in many pedons.

Geographic Setting: These soils occur on high mountain slopes and plateaus at elevations of 8,000 to 9,600 feet. Slopes are 15 to 50 percent. The soils formed in residuum weathered from granitic or metamorphic rock. The mean annual precipitation is 9 to 12 inches, mostly as winter snowfall, and the mean annual temperature is 38 to 43°F. Total snowfall is estimated at 60 to 90 inches per year. The frost-free season is 75 to 100 days.

Geographically Associated Soils: These are the frigid Torriorthents and the Cowtrack(T) soils. The frigid Torriorthents lack an argillic horizon. Cowtrack soils have about 2 feet of sandy volcanic ash over residual soils that typically have an argillic horizon.

Drainage and Permeability: Well drained; medium or rapid runoff; moderate to moderately slow permeability.

Use and Vegetation: Used for wildlife habitat. Vegetation is mainly subalpine big sagebrush, low sagebrush, desert bitterbrush, pinyon pine, curlleaf mountainmahogany, various high altitude buckwheats, Sandberg bluegrass, junegrass, and perennial forbs.

Distribution and Extent: The eastern slope of the Sierra Nevada, the Inyo-White Mountains, and the Cowtrack Mountain area. The soils are of small extent within the inventory area.

HONOVA SERIES

The Honova series consists of shallow and very shallow, well drained soils that formed from hard rhyolitic tuff. Honova soils are on nearly level to gently rolling ignimbrite flows with slopes of 0 to 9 percent. The mean annual precipitation is 6 to 8 inches and the mean annual temperature is 52 to 56°F.

Taxonomic Class: Loamy, mixed, nonacid, thermic Lithic Xeric Torriorthents

Typical Pedon: Honova very cobbly loamy sand - on a 4 percent east facing slope at 4,500 feet elevation under needleleaf rabbitbrush, spiny hopsage, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (6/29/78) the profile was dry throughout.

A1--0 to 3 inches; pale brown (10YR 6/3) very cobbly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 1 percent angular stones, 30 percent angular cobbles, and 15 percent angular pebbles (tuff fragments); mildly alkaline (pH 7.4); clear smooth boundary. (1 to 5 inches thick)

A2--3 to 5 inches; light gray (2.5Y 7/2) gravelly sandy loam, dark grayish brown (2.5Y 7/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine vesicular pores; 1 percent stones, 5 percent cobbles, and 20 percent pebbles (tuff fragments); neutral (pH 7.3); clear smooth boundary. (0 to 6 inches thick)

A3--5 to 7 inches; light gray (2.5Y 6/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine vesicular pores; 1 percent stones, 5 percent cobbles, and 5 percent pebbles (tuff fragments); neutral (pH 6.8); abrupt smooth boundary. (2 to 8 inches thick)

R--7 inches; hard rhyolitic tuff; 12 inch fracture spacing.

Type Location: Inyo County, California. About 5 miles north-northwest of Bishop on the volcanic tablelands; 100 yds. north of dirt road; at the northeast corner of the SE¼NE¼NE¼ Sec. 14, T6S, R32E, M.D.B.M.

Range in Characteristics: Depth to the hard tuff is 4 to 14 inches. The soil above the lithic contact is usually dry from mid-April to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to Dec. 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 60°F. The soil surface has a 35 to 50 percent coverage of cobbles, stones, and gravel which are angular tuff fragments. The gravel and cobbles predominate. Surface stone coverage is 1 to 3 percent. These soils contain 40 to 60 percent rhyolitic volcanic ash. The soil is neutral or mildly alkaline. Rock fragment content of the control section ranges from 20 to 30 percent, consisting of 0 to 3 percent stones, 15 to 30 percent cobbles, and 5 to 20 percent gravel. These are angular tuff fragments. The organic carbon content is 0.1 to 0.3 percent. The clay content of the textural control section averages 6 to 10 percent.

The A horizon has dry color of 10YR 5/3, 6/3, 6/4, 7/2, 7/3; 2.5Y 7/2, or 6/2, and moist color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 2.5Y 4/2, 5/2, or 7/2.

The A1 horizon contains 35 to 50 percent angular rock fragments consisting of 0 to 3 percent stones, 20 to 35 percent cobbles, and 10 to 20 percent gravel.

The A2 and A3 horizons are sandy loam or gravelly sandy loam. Rock fragment content ranges from 10 to 20 percent consisting of 0 to 3 percent stones, 5 to 10 percent cobbles, and 5 to 10 percent gravel. These are angular tuff fragments.

Geographic Setting: Honova soils are on gently undulating to rolling ignimbrite flows with slopes of 0 to 9 percent. The soils formed in hard rhyolitic tuff at elevations of 4,300 to 5,700 feet. Some of the fine-earth material is

thought to be of mixed aeolian origin. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is 54 to 56°F. The mean January temperature is about 37°F; the mean July temperature is about 76°F. The frost-free season is 150 to 175 days. Rock outcrops are associated with these soils.

Plate 47. Surface condition of Honova very cobbly loamy sand. The cobbles and gravel are fragments of the bedrock (hard volcanic tuff).

Geographically Associated Soils: These are the Chidago(T) and Hammil(T) soils. Chidago soils are 20 to 40 inches deep and are ashy. Hammil soils are greater than 60 inches deep and are ashy.

Drainage and Permeability: Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: At present, used for grazing and wildlife habitat. The vegetation consists of Nevada ephedra, shadscale, little horsebrush, Fremont dalea, Indian ricegrass, desert needlegrass, longspine horsebrush, common winterfat, blackbrush, needleleaf rabbitbrush, spiny hopsage, fourwing saltbush, Nevada dalea, and spiny menodora.

Distribution and Extent: Honova soils occur on volcanic formations in east-central California. They are of moderate extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: Honova is an Indian name that is associated with the area.

Remarks: Honova soils have an aridic moisture regime bordering on xeric.

HONOVA VARIANT

Honova Variant soils are shallow or very shallow and are somewhat excessively drained. They formed in resdiuum weathered from granitic rocks. Honova Variant soils are on undulating to gently rolling pediments around the Alabama Hills. Slopes range from 2 to 9 percent. The mean annual precipitation is about 6 inches and the mean annual temperature is about 55°F.

Taxonomic Class: Mixed, thermic, shallow Xeric Torripsamments

Typical Pedon: Honova Variant loamy coarse sand - on a 5 percent south slope at 4,900 feet elevation under Cooper goldenbush, bud sagebrush, and white burrobush vegetation. Colors are for dry soil unless otherwise stated. When described (6/27/79) the soil was dry throughout.

A--0 to 6 inches; pale brown (10YR 6/3) loamy coarse sand, brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 10 percent fine and medium pebbles; mildly alkaline (pH 7.6); abrupt irregular boundary. (5 to 9 inches thick)

Cr--6 inches; brownish yellow (10YR 6/6) decomposing granitic bedrock, dark yellowish brown (10YR 4/4) moist; massive; retains rock structure; many thin clay films stain mineral grains.

Modal Location: Inyo County, California; about 4½ miles west of Lone Pine; 10 feet north of dirt road; in the NE¼SE¼SW¼, Sec. 14, T15S, R35E, M.D.B.M.

Range in Characteristics: Depth to the paralithic contact is 5 to 20 inches. The soil above the contact is usually dry from mid-April to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The soil moisture regime is bordering on xeric. The mean annual soil temperature is about 60°F.

The A horizon has dry color of 10YR 6/3 or 6/4, and moist color of 10YR 4/2 or 4/3. The soil contains 5 to 15 percent fine and medium gravel. The soil is mildly alkaline and contains 0.2 to 0.4 percent organic carbon. In some of the deeper pedons, disseminated lime may be present in the lower A horizon.

The Cr horizon has dry color of 10YR 6/4 or 6/6, and moist color of 10YR 4/4 or 4/6. In some of the deeper pedons, a C1 horizons is above the Cr horizon.

Geographic Setting: Honova Variant soils are on undulating to gently rolling pediments around the Alabama Hills. Slopes are 2 to 9 percent. The elevation range is 4,800 to 5,200 feet. The mean annual precipitation is about 6 inches, some as snow. The mean January temperature is about 37°F; the mean July temperature is about 76°F. The mean annual temperature is about 55°F. The frost-free season is about 200 days. Rock outcrops are associated with these soils in some areas.

Geographically Associated Soils: These are the Lubkin(T), Pajuela, Thibau(T), and Tinemaha(T) soils. These soils are very deep. Lubkin soils have fine-loamy argillic horizons. Pajuela soils have sandy-skeletal particle size control sections. Tinemaha soils have loamy-skeletal argillic horizons.

Drainage and Permeability: Somewhat excessively drained; slow runoff; rapid permeability.

Use and Vegetation: Used for rangeland and wildlife habitat. The vegetation is Cooper goldenbush, spiny hopsage, bud sagebrush, white burrobush, shadscale, allscale saltbush, Nevada ephedra, longspine horsebrush, common winterfat, desert needlegrass, Indian ricegrass, white bursage, and Anderson wolfberry.

Distribution and Extent: Pediments within Owens Valley, California. The soils are of small extent within the inventory area.

HOYE VARIANT

Hoye Variant soils are very deep and well drained. They formed in mixed alluvium in valley bottoms near Benton. Slopes range from 0 to 2 percent. The mean annual precipitation is 8 to 9 inches, some as snow, and the mean annual temperature is about 51°F.

Taxonomic Class: Fine-loamy, mixed, mesic Xeralfic Haplargids

Typical Pedon: Hoye Variant heavy loam - on a slope of less than 1 percent at 5,400 feet elevation under greasewood and shadscale vegetation. Colors are for dry soil unless otherwise stated. When described (8/12/79) the soil was dry throughout.

A--0 to 7 inches; pale brown (10YR 6/3) heavy loam, brown (10YR 4/3) moist; strong coarse and very coarse platy structure parting to moderate medium angular blocky; soft, very friable, sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; strongly effervescent, lime disseminated; mildly alkaline (pH 7.8); gradual wavy boundary. (7 to 9 inches thick)

Btk--7 to 20 inches; brown (10YR 5/3) silty clay loamy, brown (10YR 4/3) moist; strong fine and medium angular blocky structure; slightly hard, friable, very sticky and very plastic; few very fine, fine, and medium roots; many very fine tubular pores; common moderately thick clay films on peds and in pores; violently effervescent, lime disseminated and segregated in common fine threads; moderately alkaline (pH 8.0); abrupt smooth boundary. (13 to 16 inches thick)

2Ab--20 to 22 inches; white (10YR 8/1) fine sandy loam, light gray (10YR 7/2) moist; moderate fine subangular blocky structure, soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (1 to 2 inches thick)

2Btb--22 to 32 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium columnar structure parting to moderate medium angular blocky; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; continuous thin and few moderately thick clay films in pores and on ped faces; neutral (pH 6.6); diffuse wavy boundary. (8 to 12 inches thick)

2C--32 to 60 inches; pale brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) moist; massive; slightly hard, friable, sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent, lime disseminated; moderately alkaline (pH 8.0).

Modal Location: Mono County, California. About 2½ miles northwest of Benton, 25 yards east of dirt road near the NW corner of NW¼SW¼SW¼ Sec. 18, T1S, R31E, M.D.B.M.

Range in Characteristics: The soil moisture control section is usually dry from early May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is about 57°F. Some volcanic ash is present in the soil.

The A horizon has dry color of 10YR 6/3 or 5/3 and moist color of 10YR 4/3. The electrical conductivity of the saturation extract ranges from 2 to 4 mmhos/cm. The organic carbon content is estimated at 0.4 to 0.6 percent. The soils is mildly to moderately alkaline. The exchangeable sodium percentage is 8 to 12 percent. Textures are loam or fine sandy loam.

The Bt horizon has dry color of 10YR 7/3, 6/4, or 5/3, and moist color of 10YR 4/3 or 4/4. Textures are silty clay loam, loam, or clay. Some stratification is usually present. Clay content ranges from 20 to 50 percent. A buried B horizon is present is many pedons below the present B horizon. The B horizon is nonsaline and nonsodic. Soil reaction is neutral to moderately alkaline. The exchangeable sodium percentage is 5 to 8 percent.

The C horizon has dry color of 10YR 6/4, 6/3, or 5/3, and moist color of 10YR 4/3, or 4/4. Textures are silt loam or heavy silt loam, with strata of loamy sand present in some pedons. The C horizon is nonsaline and nonsodic. The exchangeable sodium percentage is 3 to 5 percent.

Geographic Setting: These soils occur in nearly level, low areas near Benton. Slopes are 0 to 2 percent. The elevation range is 5,300 to 5,600 feet. The soil formed in silty alluvium from surrounding soils. The mean annual precipitation is 8 to 9 inches, some as snow. The mean January temperature is about 34°F; mean July temperature is about 72°F. The mean annual temperature is about 51°F. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Brantel(T), Rovana(T), and Sawavu(T) soils. Brantel and Sawavu soils are ashy and lack argillic horizons. Rovana soils are sandy and lack argillic horizons.

Drainage and Permeability: Well drained; very slow or ponded runoff; very slow permeability. The soils may flood briefly in very wet years.

Use and Vegetation: Used for grazing, agriculture, and wildlife habitat. Some areas have been cultivated in the past. Cultivated areas support Russian thistle, shadscale, greasewood, and annual grasses and forbs. Native areas support fourwing saltbush, big sagebrush, common winterfat, Indian ricegrass, galleta grass, and annual forbs.

Distribution and Extent: Valley floors in Mono County, California. The soils are of small extent within the inventory area.

LITHIC HAPLARGIDS

These soils are shallow or very shallow, well drained, and formed in residuum weathered from metasedimentary, metavolcanic, and granitic rocks. Slopes are 30 to 75 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F.

Reference Pedon: extremely gravelly silt loam - on a 45 percent southwest slope at 6,300 feet elevation under desert needlegrass, shadscale, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (6/14/79) the soil was dry throughout.

The soil surface is paved with 1 percent angular stones, 20 percent angular cobbles, and 45 percent angular pebbles.

A1--0 to 1 inch; light gray (10YR 7/2) extremely gravelly silt loam, brown (10YR 4/3) moist; weak medium platy structure; slightly hard, friable, nonsticky, and nonplastic; common very fine interstitial pores; 1 percent angular stones, 20 percent angular cobbles, and 45 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--1 to 4 inches; light gray (10YR 7/2) gravelly silt loam, brown (10YR 4/3) moist; moderate coarse platy structure; slightly hard, very friable; slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; 1 percent angular cobbles and 15 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.2); abrupt wavy boundary.

Bt--4 to 11 inches; pale brown (10YR 6/3) gravelly silty clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and few fine roots; common very fine tubular pores; many thin clay films on peds and bridging mineral grains; 1 percent angular cobbles and 15 percent angular pebbles; violently effervescent, lime disseminated and segregated in few fine soft masses; moderately alkaline (pH 8.2); clear irregular boundary.

Cr--11 to 19 inches; decomposing, fractured metavolcanic rock; retains rock structure; average fracture spacing ¼ to 2 inches.

R--19 inches; hard, fractured metavolcanic rock.

Location: Inyo County, California. About 13 miles east of Lone Pine on the west side of Inyo Mountains; 15 feet east of dirt road near dark-colored rock outcrop at bend in road; 36° 34' 11" N. Lat., 117° 52' 4" W. Long.

Range in Characteristics: Depth to hard bedrock is 7 to 20 inches. The soil above the lithic contact is usually dry from early April through November, and is intermittently moist in some part of the control section the rest of the time. It is not moist for as long as 90 consecutive days in most years. The soil temperature rarely goes below 8°C. The mean annual soil temperature is 59 to 64°F. A surface pavement of angular gravel and cobbles covers 40 to 80 percent of the soil surface.

The A horizon has dry color of 10YR 6/2, 6/3, 7/2, 7/3, 7/4, or 2.5Y 7/2, and moist color of 10YR 4/3, 5/3, 5/4, or 2.5Y 4/2. Textures are silt loam or sandy loam with gravelly, very gravelly or extremely gravelly modifiers. The subsurface vesicular layer has textures of gravelly or very gravelly silt loam or sandy loam. Rock fragment content ranges from 15 to 80 percent and is mostly angular gravel and cobbles, with a few angular stones in some areas. Granitic areas have more cobbles, stones, and boulders percent, and surface textures of loamy coarse sand or coarse sandy loam. The electrical conductivity of the saturation extract ranges from 0.5 to 2.0 mmhos/cm. The exchangeable sodium percentage ranges from 5 to 20. The soil contains 1 to 6 ppm of boron and 1 to 15 percent carbonates by weight. The organic carbon content is less than 0.3 percent.

The B horizon has dry color of 10YR 6/3, 6/4, or 2.5Y 7/4, and moist color of 10YR 4/3, 4/4, 5/4, or 2.5Y 6/2. Textures are gravelly or very gravelly silty clay loam or sandy clay loam. Rock fragment content ranges from 15 to 60 percent and is mostly angular gravel and cobbles. Chemical properties are similar to the A horizon. The Cr horizon is absent in some pedons.

Geographic Setting: These soils occur on mountain slopes at elevations of 3,700 to 6,400 feet. The soils formed in residuum weathered from fractured metasedimentary, metavolcanic, and granitic rocks. Slopes are 30 to 75 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F. The frost-free season is 150 to 200 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Yermo soils and the Lithic Torriorthents. Yermo soils are very deep alluvial soils in canyon bottoms. Lithic Torriorthents lack an argillic horizon.

Drainage and Permeability: Well drained; rapid or very rapid runoff; moderately slow permeability.

Use and Vegetation: Used for wildlife habitat and limited grazing. Vegetation is mainly shadscale, white bursage, Nevada ephedra, Fremont dalea, longspine horsebrush, California buckwheat, desert peach, desert-trumpet, Cooper goldenbush, spiny hopsage, and annual forbs. Grasses are mainly desert needlegrass and Indian ricegrass.

Distribution and Extent: The Inyo Mountains and various other small hills of Owens Valley in Inyo County, California. The soils are of small extent within the inventory area.

LITHIC TORRIORTHENTS

These soils are shallow or very shallow, well drained, and formed in residuum weathered from metasedimentary, metavolcanic, and granitic rocks. Slopes are 30 to 75 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F.

Reference Pedon: extremely gravelly sandy loam - on a 34 percent southwest slope at 4,800 feet elevation under shadscale, white bursage, desert needlegrass, California buckwheat, and desert peach vegetation. Colors are for dry soil unless otherwise stated. When described (6/26/79) the soil was dry throughout.

The soil surface is paved with 2 percent angular stones, 5 percent angular cobbles, and 70 percent angular pebbles.

A1--0 to 1 inch; pale brown (10YR 6/3) extremely gravelly sandy loam, brown (10YR 4/3) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; common very fine vesicular pores; 2 percent angular stones, 5 percent angular cobbles, and 70 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--1 to 3 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine and few fine vesicular pores; 2 percent angular stones, 5 percent angular cobbles, and 30 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); clear wavy boundary.

A3--3 to 5 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; 2 percent angular stones, 5 percent angular cobbles, and 40 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); clear wavy boundary.

R--5 inches; hard highly fractured, calcareous, metasedimentary marine shale.

Location: Inyo County, California. About 5 miles east-northeast of Lone Pine; 36° 37' 52" N. Lat., 117° 58' 3" W. Long.

Range in Characteristics: Depth to hard bedrock is 3 to 20 inches. The soil above the lithic contact is usually dry from early April through November, and is intermittently moist in some part of the control section the rest of the time. It is not moist for as long as 90 consecutive days in most years. The soil temperature rarely goes below 8°C. The mean annual soil temperature is 59 to 64°F. A surface pavement of angular gravel and cobbles covers 40 to 80 percent of the soil surface.

The A horizon has dry color of 10YR 6/2, 6/3, 6/4, 7/2, 7/3, 2.5Y 7/2, or 7/4, and moist color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4, 2/5Y 5/4, or 6/4. Textures are sandy loam or silt loam with gravelly, very gravelly, or extremely gravelly modifiers. The subsurface vesicular layer has textures of gravelly or very gravelly silt loam or sandy loam. Rock fragment content ranges from 15 to 80 percent and is mostly angular gravel and cobbles, with a few angular stones in some areas. Granitic areas have more cobbles, stones, and boulders present, and textures are loamy coarse sand or coarse sandy loam. The electrical conductivity of the saturation extract ranges from 0.5 to 2.0 mmhos/cm. The exchangeable sodium percentage ranges from 5 to 20. The soil contains 1 to 6 ppm of boron and 1 to 15 percent carbonates by weight. The organic carbon content is less than 0.3 percent.

The C horizon, where present, has dry color of 10YR 6/4, 7/3, or 2.5Y 7/4, and moist color of 10YR 4/3, 4/4, 5/6, or 2.5Y 5/4. Textures are sandy loam or silt loam with gravelly or very gravelly modifiers. Rock fragment content is 15 to 60 percent and is mostly angular gravel and cobbles. Chemical properties are similar to the A horizon. A Cr horizon is present is some pedons above the R layer.

Geographic Setting: These soils occur on mountain slopes at elevations of 3,700 to 6,400 feet. The soils formed in residuum from fractured metasedimentary, metavolcanic, and granitic rocks. Slopes are 30 to 75 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 54 to 59°F. The frost-free season is 150 to 200 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Yermo soils and the Lithic Haplargids. Yermo soils are very deep alluvial soils in canyon bottoms. Lithic Haplargids have an argillic horizon.

Drainage and Permeability: Well drained; rapid or very rapid runoff; moderate to moderately rapid permeability.

Use and Vegetation: Used for wildlife habitat and limited grazing. Vegetation is mainly shadscale, white bursage, Nevada ephedra, Fremont dalea, longspine horsebrush, California buckwheat, desert peach, desert trumpet, Cooper goldenbush, spiny hopsage, and annual forbs. Grasses are mainly desert needlegrass and Indian ricegrass.

Distribution and Extent: The Inyo Mountains and various other small hills of Owens Valley in Inyo County, California. The soils are of moderate extent within the inventory area.

LITHIC XERIC TORRIORTHENTS

These soils are shallow or very shallow, well drained, and formed in residuum weathered from metasedimentary, metavolcanic, or granitic rock. Slopes are 15 to 75 percent. The mean annual precipitation is 6 to 10 inches and the mean annual temperature is 43 to 53°F.

Reference Pedon: very gravelly sandy loam - on a 30 percent southwest slope at 8,100 feet elevation under singleleaf pinyon, big sagebrush, desert bitterbrush, and green Mormon-tea vegetation. Colors are for dry soil unless otherwise stated. When described (8/14/79) the soil was very slightly moist in the Cr horizon.

The soil surface is covered with 1 percent angular stones, 10 percent angular cobbles, and 45 percent angular pebbles.

A1--0 to 1 inch; light brownish gray (10YR 6/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure, soft, friable, nonsticky and nonplastic; common very fine interstitial pores; 1 percent angular stones, 10 percent angular cobbles, and 45 percent angular pebbles; neutral (pH 7.0); abrupt smooth boundary.

A2--1 to 3 inches; light brownish gray (10YR 6/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine interstitial and few very fine vesicular pores; 1 percent angular stones, 10 percent angular cobbles, and 20 percent angular pebbles; neutral (pH 6.8); clear wavy boundary. inches

Cr--3 to 7 inches; pale brown (10YR 6/3) decomposing dacitic rock, brown (10YR 4/3) moist; retains rock structure; few thin clay films bridging mineral grains; clear irregular boundary.

R--7 inches; hard, fractured dacitic bedrock.

Location: Inyo County, California. About 4½ miles southeast of New York Butte on the west slope of the Inyo Mountains; 75 feet east of the Swansea dirt road; 36° 36' 30" N. Lat., 117° 3' 31" W. Long.

Range in Characteristics: Depth to hard bedrock is 3 to 20 inches. These soils (above the lithic contact) are usually dry from early May through November, and are moist in some part the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 47 to 59°F. A surface pavement of angular gravel and cobbles covers 50 to 80 percent of the soil surface. A few angular stones are present in some areas. Carbonates are present in many pedons formed from metasedimentary bedrock.

The A horizon has dry color of 10YR 5/2, 5/3, 5/3, 6/2, 7/3, 2.5Y 6/4, or 6/6, and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 2.5Y 5/2, or 6/6. Textures are sandy loam, loam, or loamy sand, with gravelly, cobbly, very gravelly, very cobbly, or extremely gravelly modifiers. Rock fragment content is 15 to 60 percent and is mostly angular gravel and cobbles, with a few angular stones in some areas. The average organic carbon content of the A horizon as a whole is 0.4 to 0.6 percent. A thin (½-1") organic layer of pine needles is present under the pinyon canopies. Clay content ranges from 6 to 18 percent.

The C horizon has dry color of 10YR 6/3, 7/3, or 2.5Y 7/3, and moist color of 10YR 4/3 or 2.5Y 5/3. Textures are similar to the A horizon. The C

horizon may be absent in some pedons or may consist of a Cr horizon.

Geographic Setting: These soils occur on mountain slopes at elevations of 5,400 to 8,500 feet. The soils formed in residuum weathered from fractured metasedimentary or metavolcanic rock. Slopes are 15 to 75 percent. The mean annual precipitation is 6 to 10 inches, some if it as snow, and the mean annual temperature is 43 to 53°F. Total snowfall is estimated at 20 to 60 inches per year. The frost-free season is 100 to 150 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Buscones soils and the Lithic Xerollic Haplargids. Buscones soils have ashy mineralogy. Lithic Xerollic Haplargids have an argillic horizon.

Drainage and Permeability: Well drained; rapid or very rapid runoff; moderate to rapid permeability.

Use and Vegetation: Used for wildlife habitat and limited grazing. Vegetation is mainly big sagebrush, desert bitterbrush, singleleaf pinyon pine, Nevada ephedra, green Mormon tea, Douglas rabbitbrush, rubber rabbitbrush, spiny hopsage, longspine horsebrush, perennial forbs, and annual forbs. Grasses are mainly desert needlegrass, Indian ricegrass, and bottlebrush squirreltail.

Distribution and Extent: The White-Inyo Mountains and the Benton Range in Inyo and Mono Counties, California. The soils are of small extent within the inventory area.

LITHIC XEROLLIC HAPLARGIDS

These soils are shallow or very shallow, well drained, and formed in residuum weathered from metasedimentary or metavolcanic rock. Slopes are 30 to 75 percent. The mean annual precipitation is 6 to 10 inches and the mean annual temperature is 43 to 53°F.

Reference Pedon: extremely gravelly loam - on a 30 percent southwest slope at 7,100 feet elevation under big sagebrush, Douglas rabbitbrush, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (9/12/78) the soil was dry throughout.

The soil surface is covered with 2 percent angular stones, 5 percent angular cobbles, and 65 percent angular pebbles.

A1--0 to 1 inch; light brown (7.5YR 6/4) extremely gravelly loam, dark brown (7.5YR 4/4) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; common fine vesicular pores; 2 percent angular stones, 5 percent angular cobbles, and 65 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--1 to 3 inches; light brown (7.5YR 6/4) very gravelly loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine vesicular pores; 2 percent angular stones, 5 percent angular cobbles, and 30 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.2); abrupt smooth boundary.

Bt--3 to 10 inches; light reddish brown (5YR 6/4) gravelly silty clay loam, reddish brown (5YR 5/4) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine roots; few fine and very fine tubular pores; common moderately thick clay films on peds; 2 percent angular stones, 15 percent angular cobbles, and 10 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.2); abrupt wavy boundary.

R--10 inches; highly fractured dolomite shale.

Location: Inyo County, California. About 13 miles east-southeast of Lone Pine and 3 miles northwest of Cerro Gordo Peak; 36° 33' 10" N. Lat., 117° 51' 1" W. Long.

Range in Characteristics: Depth to hard bedrock is 7 to 20 inches. These soils (above the lithic contact) are usually dry from early May through November, and are moist in some part the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 47 to 50°F. A surface pavement of angular gravel and cobbles cover 50 to 80 percent of the soil surface. A few angular stones are present in some areas.

The A horizon has dry color of 10YR 5/2, 6/3, 7/2, 7/3, 7/4, 2.5Y 6/4, 7/2, 7/3, or 7.5YR 6/4. It has moist color of 10YR 3/2, 3/3, 4/2, 4/3, 5/4, 2.5Y 4/2, 4/4, or 7.5YR 4/4. Textures are sandy loam or loam with gravelly, very gravelly, or extremely gravelly modifiers. Rock fragment content is 15 to 80 percent and is mostly angular gravel and cobbles, with a few angular stones in some areas. The average organic carbon content of the A horizon as a whole is 0.4 to 0.6 percent. A thin (½-1 inch) organic layer of pine needles is present under the pinyon canopies. Carbonates are present in many pedons. Clay content ranges from 6 to 18 percent.

The B horizon has dry color of 10YR 6/3, 6/4, 7/2, 7/3, 8,2, 7.5YR 5/4, 5/6, 6/4, 5YR 6/4, or 2.5Y 6/4. It has moist color of 10YR 3/3, 4/3, 4/4, 5/3, 5/4, 7.5YR 4/4, 4/6, 5YR 5/4, or 2.5Y 5/4. Textures are sandy clay loam, silty clay loam, heavy sandy loam, or clay loam with gravelly, cobbly, or very gravelly modifiers. Rock fragment content is 15 to 60 percent and is mostly angular gravel and cobbles. Clay content ranges from 18 to 40 percent.

In pedons that are deeper than 20 inches, a C horizon is usually present having colors, textures, and rock fragment content similar to the A horizon. The underlying bedrock usually has many fractures spaced ¼" to 3" apart.

Geographic Setting: These soils occur on mountain slopes at elevations of 5,600 to 8,500 feet. The soils formed in residuum weathered form fractured metasedimentary or metavolcanic rock. Slopes are 30 to 75 percent. The

mean annual precipitation is 6 to 10 inches, some of it as snow, and the mean annual temperature is 43 to 53°F. Total snowfall is estimated at 20 to 60 inches per year. The frost-free season is 100 to 150 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Lithic Xeric Torriorthents. Lithic Xeric Torriorthents lack an argillic horizon.

Drainage and Permeability: Well drained; rapid or very rapid runoff; moderately slow permeability.

Use and Vegetation: Used for wildlife and limited grazing. Vegetation is mainly big sagebrush, desert bitterbrush, singleleaf pinyon pine, Nevada ephedra, green Mormon-tea, Douglas rabbitbrush, rubber rabbitbrush, spiny hopsage, and annual forbs. Grasses are mainly desert needlegrass, Indian ricegrass, and bottlebrush squirreltail.

Distribution and Extent: The White-Inyo Mountains and the Benton Range in Inyo and Mono Counties, California. The soils are of small extent within the inventory area.

LUBKIN SERIES

The Lubkin series consists of very deep, well drained soils that formed in granitic alluvium. Lubkin soils are on alluvial fans and fan terraces with slopes of 5 to 15 percent. The mean annual precipitation is 6 to 8 inches, and the mean annual temperature is about 55°F.

Taxonomic Class: Coarse-loamy, mixed, thermic Xeralfic Haplargids

Typical Pedon: Lubkin loamy coarse sand - on a 5 percent east slope at 4,620 feet elevation under spiny hopsage, Cooper goldenbush, white burrobush, Nevada ephedra, rayless goldenhead, blackbrush, and Anderson wolfberry vegetation. Colors are for dry soil unless otherwise stated. When described (11/30/77) the soil was moist above 15 inches.

Surface coverage of rock fragments: less than 1 percent stones and cobbles, and 10 percent fine and medium pebbles; one-eight inch platy surface crust.

A--0 to 4 inches; light yellowish brown (10YR 6/4) loamy coarse sand, dark yellowish brown (10YR 4/4) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; 1 percent boulders, stones, and cobbles, 10 percent fine pebbles; mildly alkaline (pH 7.5); abrupt smooth boundary. (2 to 10 inches thick)

Bt1--4 to 12 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, common very fine interstitial and tubular pores; few thin clay films bridging mineral grains; 15 percent fine pebbles; mildly alkaline (pH 7.5); clear wavy boundary. (6 to 10 inches thick)

Bt2--12 to 17 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; few thin and moderately thick clay films on peds, in pores, and bridging sand grains; 15 percent fine pebbles; mildly alkaline (pH 7.5); clear wavy boundary. (5 to 8 inches thick)

Bt3--17 to 36 inches; very pale brown (10YR 7/4) gravelly sandy loam, light yellowish brown (10Y 6/4) moist; weak coarse subangular blocky structure, very hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; common thin clay films in pores and bridging mineral grains; 30 percent fine and coarse pebbles; mildly alkaline (pH 7.5); clear wavy boundary. (10 to 20 inches thick)

C--36 to 60 inches; light yellowish brown (2.5Y 6/4) gravelly loamy coarse sand, light olive brown (2.5Y 5/4) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; 10 percent cobbles and 15 percent pebbles; mildly alkaline (pH 7.5).

Type Location: Inyo County, California. About 10 miles south-southeast of Independence in Owens Valley; 20 yds. north of dirt road at the northwest corner of the SW¼ Sec. 3, T15S, R35E, M.D.B.M.

Range in Characteristics: The solum ranges from 25 to 40 inches thick. These soils are usually dry from the end of April to the end of November, and are moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to Dec. 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 63°F. Rock fragments tend to be rounded or have rounded edges. The surface rock fragment coverage ranges from 10 to 25 percent with 0 to 3 percent boulders and stones, 0 to 5 percent cobbles, and 10 to 15 percent gravel. The soil is neutral to mildly alkaline.

The A horizon has dry color of 10YR 6/3, 6/4, or 7/4, and moist color of 10YR 4/3, 4/4, or 5/3. Rock fragment content ranges from 5 to 15 percent with 0 to 3 percent boulders and stones, 0 to 10 percent cobbles, and 5 to 15 percent gravel. The organic carbon content is 0.2 to 0.4 percent. Some pedons have fragile vesicular layers near the surface.

The Bt horizon has dry color of 10YR 5/4, 6/4, or 7/4, and moist color of 10YR 4/4, 5/4, or 6/4. Rock fragment content is 15 to 35 percent with 0 to 10 percent boulders and stones, 0 to 15 percent cobbles, and 5 to 30 percent gravel. The organic carbon content is 0.2 to 0.3 percent. The clay content of the Bt horizon is 10 to 18 percent.

The C horizon has dry color of 10YR 6/4, 7/4, or 2.5Y 6/4, and moist color of 10YR 4/4, 5/4, or 2.5Y 4/4. Rock fragment content ranges from 15 to 35 percent with 0 to 10 percent boulders and stones, 5 to 15 percent cobbles, and 10 to 30 percent gravel. Textures are gravelly or cobbly loamy coarse sand.

Geographic Setting: Lubkin soils formed on older granitic alluvial fans and fan terraces. Many of these fans and fan terraces form long aprons along mountain range fronts. They are dissected with some washes and shallow drainageways. Lubkin soils are associated with bouldery and very bouldery

soils on many of these fans, however, Lubkin soils occupy positions where there are few or no boulders or stones. Slopes are 5 to 15 percent. Elevations range from 4,000 to 5,400 feet. The mean annual precipitation is 6 to 8 inches. The mean January temperature is about 39°F; mean July temperature is about 77°F; mean annual temperature is 54 to 57°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Pajuela, Thibau(T), and Tinemaha(T) soils. Pajuela soils have sandy-skeletal control sections. Thibau soils lack argillic horizons and are sandy in the particle-size control section. Tinemaha soils have loamy-skeletal argillic horizons.

Drainage and Permeability; Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly blackbrush, spiny hopsage, Cooper goldenbush, white burrobush, longspine horsebrush, Nevada ephedra, needleleaf rabbitbrush, Fremont dalea, desert needlegrass, common winterfat, Indian ricegrass, annual forbs, Anderson wolfberry, and other shrubs.

Distribution and Extent: Alluvial fans and fan terraces east of the Sierra Nevada. The soils are of small extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Lubkin Creek.

Remarks: Lubkin soils have an aridic moisture regime that borders on xeric.

MILLNER SERIES

The Millner series consists of very deep, well drained soils that formed in gravelly alluvium weathered from metasedimentary and metavolcanic rock sources. Millner soils are on moderately to strongly sloping alluvial fans. Slopes are 5 to 15 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is 54 to 56°F.

Taxonomic Class: Loamy-skeletal, mixed (calcareous), thermic Xeric Torriorthents

Typical Pedon: Millner very gravelly sandy loam - on a 5 percent west facing slope at 4,700 feet elevation under spiny hopsage, Fremont dalea, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (9/78) the soil was dry throughout.

A1--0 to 1 inch; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine platy structure; soft, very friable, nonsticky and nonplastic; few very fine vesicular pores; 1 percent angular stones, 10 percent angular cobbles, and 40 percent angular pebbles; mildly alkaline (pH 7.6); abrupt smooth boundary. (½ to 1 inch thick)

A2--1 to 8 inches; pale brown (10YR 6/3) gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine vesicular and common very fine interstitial pores; 1 percent angular stones, 5 percent angular cobbles, and 10 percent angular pebbles; mildly alkaline (pH 7.6); abrupt wavy boundary. (7 to 10 inches thick)

Ck--8 to 33 inches; pale brown (10YR 6/3) very gravelly fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, medium, and coarse roots; many very fine interstitial pores; 5 percent angular stones, 10 percent angular cobbles and 30 percent angular pebbles; slightly effervescent, lime disseminated and thin lime accumulations on undersides of rock fragments; mildly alkaline (pH 7.6); abrupt wavy boundary. (20 to 30 inches thick)

2C1--33 to 42 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent angular cobbles and 5 percent pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 7.9); abrupt wavy boundary. (0 to 12 inches thick)

3C2--42 to 60 inches; light yellowish brown (10YR 6/4) cobbly sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 20 percent angular cobbles and 5 percent angular pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0).

Type Location: Mono County, California. About 5.75 miles south of Hammil on the Millner Creek fan; 20 feet north of dirt road in the SE¼SE¼NE¼SW¼ Sec. 18, T4S, R33E, M.D.B.M.

Range in Characteristics: The soil is usually dry from the end of April to late November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to Dec. 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 63°F. The surface pavement covers 35 to 60 percent of the soil surface, with 0 to 5 percent stones. Rock fragments tend to be angular and somewhat flattened in shape. The soil is mildly or moderately alkaline.

The A horizon has dry color of 10YR 8/3, 7/3, or 6/3, and moist color of 10YR 6/3, 5/3, 4/3, or 2.5Y 4/2. Rock fragment content ranges from 15 to 60 percent with 0 to 5 percent angular stones, 1 to 20 percent angular cobbles, and 5 to 40 percent angular gravel. Textures are gravelly sandy loam, very gravelly sandy loam, or stony sandy loam. The organic carbon content is 0.15 to 0.3 percent. The soil is noneffervescent or slightly effervescent.

The C horizon has dry color of 10YR 7/3, 6/3, or 6/4, and moist color of 10YR 5/3, 5/4, 4/3, 4/4, or 2.5Y 4/2. Rock fragment content averages 35 to 60 percent in the textural control section with 0 to 10 angular percent stones, 5 to 30 percent angular cobbles, and 5 to 50 percent angular gravel. Textures are sandy loam, very gravelly or very cobbly fine sandy loam, or cobbly sandy loam. Some stratification is present. The C horizon is slightly or strongly effervescent.

Geographic Setting: Millner soils are on moderately to strongly sloping alluvial fans and have slopes of 5 to 15 percent. Many of these fans are dissected with small shallow washes and drainages. Narrow stringers of angular stones and cobbles radiate down the fans from the canyon mouths. The soils formed in alluvium from metasedimentary and metavolcanic rock sources. Elevations range from 4,400 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, with some as snow. The mean January temperature is about 35°F; mean July temperature is about 74°F. The mean annual temperature is 54 to 56°F. The frost-free season is 150 to 160 days.

Geographically Associated Soils: This is the Yermo soil. Yermo soils have an aridic moisture regime, but are dry for more than 75 percent of the time.

Drainage and Permeability: Well drained; medium runoff; moderately rapid permeability.

Use and Vegetation: Used principally for grazing, wildlife habitat, and gravel extraction. Vegetation is mainly spiny hopsage, Fremont dalea, Nevada ephedra, longspine horsebrush, common winterfat, needleleaf rabbitbrush, staghorn cholla, shadscale, desert needlegrass, and Indian ricegrass, annual forbs, and perennial forbs.

Distribution and Extent: Alluvial fans east of the Sierra Nevada in California. The soils are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Millner Creek.

Remarks: Millner soils have an aridic moisture regime that borders on xeric.

PAJUELA SERIES

The Pajuela series consists of very deep, somewhat excessively drained soils that formed in granitic alluvium. Pajuela soils are on moderately to strongly sloping bouldery alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 6 to 8 inches, and the mean annual temperature is about 55°F.

Taxonomic Class: Sandy-skeletal, mixed, thermic Xeric Torriorthents

Typical Pedon: Pajuela bouldery heavy loamy coarse sand - on an 11 percent east-northeast slope at 4,200 feet elevation under burrobrush, longspine horsebrush, needleleaf rabbitbrush, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (3/27/80) the soil was moist above 10 inches.

Surface coverage of rock fragments: 3 percent boulders, 5 percent stones, 5 percent cobbles, and 15 percent pebbles, 1/8 inch platy surface crust.

A1--0 to 1 inch; brown (10YR 5/3) bouldery heavy loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 3 percent boulders, 5 percent stones, 5 percent cobbles, and 15 percent pebbles; neutral (pH 6.8); abrupt smooth boundary. (0 to 5 inches thick)

A2--1 to 12 inches; pale brown (10YR 6/3) bouldery heavy loamy coarse sand, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 3 percent boulders, 5 percent stones, 5 percent cobbles, and 15 percent pebbles; mildly alkaline (pH 7.4); clear smooth boundary. (0 to 25 inches thick)

C--12 to 60 inches; pale brown (10YR 6/3) extremely stony heavy loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 10 percent boulders, 20 percent stones, 20 percent cobbles, and 20 percent pebbles; mildly alkaline (pH 7.4).

Type Location: Inyo County, California. About 8.2 miles south of Aberdeen in Owens Valley; 25 yards south of dirt road and 20 yards west of fence intersecting road; in the SE¼NE¼SE¼ Sec. 28, T12S, R34E, M.D.B.M.

Range in Characteristics: These soils are usually dry from the end of April to the end of November, and are moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to Dec. 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 63°F. Rock fragments tend to be rounded or have rounded edges. The surface rock fragment coverage ranges from 30 to 90 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 10 to 20 percent gravel (mostly fine). Some boulders exceed 6 feet in diameter. The soil is neutral or mildly alkaline.

The A horizon has dry color of 10YR 7/2, 7/3, 6/3, 6/4, or 5/3, and moist color of 10YR 5/2, 5/3, 4/3, or 3/3. Rock fragment content ranges from 15 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 10 to 20 percent gravel. Textures are bouldery or very bouldery loamy coarse sand. Some profiles have a thin fragile layer just below the surface that has vesicular pores. The organic carbon content is 0.2 to 0.4 percent.

The C horizon has dry color of 10YR 7/2, 7/3, 7/4, 6/3, or 5/4, and moist color of 10YR 5/2, 5/3, 5/4, 4/3, or 4/4. Rock fragment content ranges from 35 to 80 percent for the 10 to 40 inch control section with 10 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 10 to 20 percent gravel. Textures are loamy coarse sand with very cobbly, very stony, or extremely stony modifiers. In some profiles, lenses of light sandy loam are present.

Geographic Setting: Pajuela soils formed on recent granitic alluvial fans and fan terraces. Many of these fans and fan terraces form long aprons along mountain range fronts. They are dissected with some drainageways and shallow washes. Slopes are 5 to 15 percent. Elevations range from 4,000 to 5,500 feet. The mean annual precipitation is 6 to 8 inches. The mean January temperature is about 37°F; mean July temperature is 78°F; mean annual temperature is 54 to 57°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Lubkin(T), Tinemaha(T), and Thibau(T) soils. Tinemaha and Lubkin soils have argillic horizons with sandy loam and sandy clay loam textures. Thibau soils average less than 35 percent rock fragments in the textural control section.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used principally for rangeland and wildlife habitat. Vegetation is mainly spiny hopsage, Nevada ephedra, Cooper goldenbush, Fremont dalea, white burrobush, longspine horsebrush, needleleaf rabbitbrush, blackbrush, Anderson wolfberry, bud sagebrush, California buckwheat, common winterfat, desert needlegrass, and Indian ricegrass.

Distribution and Extent: Alluvial fans and fan terraces along the eastern Sierra Nevada in California. The soils are of moderate extent.

Series Established: Kern County, California, Southeastern Part, 1976.

PIZONA SERIES

The Pizona series consists of deep, well drained, stony soils. They formed in material weathered from basaltic bedrock with some volcanic ash overburden. Pizona soils are on moderately sloping to steep hillsides. Slopes are 9 to 50 percent. The mean annual precipitation is 8 to 12 inches and the mean annual temperature is 44 to 50°F.

Taxonomic Class: Loamy-skeletal, mixed, mesic Xeralfic Haplargids

Typical Pedon: Pizona stony loamy sand - on a 41 percent east slope at 6,720 feet elevation under big sagebrush, green Mormon tea, and pinyon pine vegetation. Colors are for dry soil unless otherwise stated. When described (6/30/80) the soil was moist below 3 inches.

The soil surface is covered with angular or flaggy rock fragments: 10 percent pebbles, 10 percent cobbles, 3 percent stones.

A1--0 to 3 inches; light brownish gray (10YR 6/2) stony loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 10 percent pebbles, 10 percent cobbles, and 3 percent stones; neutral (pH 6.6); abrupt irregular boundary. (2 to 3 inches thick)

A2--3 to 5 inches; light gray (10YR 6/2) stony loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; 5 percent pebbles, 10 percent cobbles, and 3 percent stones; neutral (pH 7.3); abrupt irregular boundary. (0 to 2 inches thick)

A3--5 to 11 inches; light gray (10YR 7/2) stony loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 10 percent pebbles, 10 percent cobbles, and 3 percent stones; neutral (pH 7.3); clear wavy boundary. (3 to 10 inches thick)

2Ab--11 to 17 inches; pale brown (10YR 6/3) cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; 20 percent pebbles, 10 percent cobbles, and 1 percent stones; mildly alkaline (pH 7.5); clear wavy boundary. (4 to 7 inches thick)

2Btb1--17 to 24 inches; light yellowish brown (10YR 6/4) very cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular and interstitial pores; few thin clay films in pores and on peds; 25 percent pebbles, 15 percent cobbles, 1 percent stones; mildly alkaline (pH 7.6); clear wavy boundary. (5 to 10 inches thick)

2Btb2--24 to 36 inches; light yellowish brown (10YR 6/4) very cobbly light sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; few very fine tubular and interstitial pores; many thin and few moderately thick clay films on peds and in pores; 25 percent pebbles, 15 percent cobbles, and 1 percent stones; mildly alkaline (pH 7.7); clear wavy boundary. (8 to 15 inches thick)

2Btqb--36 to 44 inches; light yellowish brown (10YR 6/4) very cobbly heavy sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular and interstitial pores; common thin clay films on peds and in pores; slight silica cementation; 25 percent pebbles, 15 percent cobbles, and 1 percent stones; mildly alkaline (pH 7.6); gradual wavy boundary. (5 to 15 inches thick)

2R--44 inches; hard, fractured basaltic rock; average fracture spacing 12 inches; some clay films coat rock surfaces.

Type Location: Mono County, California. About 14 miles northwest of Benton and 4½ miles west of Adobe Lake; about 800 feet southwest of dirt road on east-facing hillside, 50 feet northwest of large pinyon tree in the NW¼NW¼SE¼ Sec. 1, T1N, R29E, M.D.B.M.

Range in Characteristics: Depth to basaltic bedrock is 40 to 60 inches. The soil between depths of 12 and 30 inches is usually dry from mid-May until some time in November, and is moist in some part the rest of the time. The soil temperature is above 5°C from April 1 to December 15, and is above 8°C from April 15 to December 1. Summer thunderstorms occur, but are spotty and usually do not wet the moisture control section. The mean annual soil temperature is 47 to 55°F. Most of the rock fragments are angular or flaggy basaltic fragments. Rock fragments cover 20 to 60 percent of the soil surface and in many areas project 3 to 20 inches above the soil surface. Surface stone coverage is 3 to 15 percent. The dry bulk density of the ashy

overburden is 1.1 to 1.25 g/cc and the moist bulk density is 1.3 to 1.45 g/cc.

The A horizon has dry color of 10YR 6/2 or 7/2, and moist color of 10YR 4/2, 5/3 or 5/2. The slight vesicular layer is absent in some areas, but where present, it is usually a loamy sand texture. The ashy overburden is 6 to 14 inches thick. Rock fragment content is 15 to 35 percent, consisting of 5 to 15 percent gravel, 5 to 15 percent cobbles, and 3 to 15 percent stones. The organic carbon content is 0.1 to 0.3 percent.

The 2Ab horizon has dry color of 10YR 6/2 or 6/3, and moist color of 10YR 4/4, 4/2, or 4/3. Textures are cobbly, stony, or very cobbly sandy loam. Rock fragment content is 20 to 45 percent, consisting of 10 to 20 percent gravel 5 to 15 percent cobbles, and 3 to 15 percent stones.

The 2Btb horizon has dry color of 10YR 6/2, 6/3 or 6/4, and moist color of 10YR 4/2, 4/3, or 4/4. Textures are very cobbly or very stony sandy loam or sandy clay loam. Clay content ranges from 12 to 30 percent. Rock fragment content is 35 to 60 percent, consisting of 10 to 20 percent gravel, 15 to 25 percent cobbles, and 1 to 20 percent stones.

Geographic Setting: Pizona soils are on mountain slopes of 9 to 50 percent, and occur at elevations of 5,800 to 7,600 feet. The soils formed in material weathered from basaltic rock, with a subsequent aerial deposition of rhyolitic volcanic ash. The mean annual precipitation is 8 to 12 inches, much of it as snow. The mean January temperature is about 30°F; the mean July temperature is about 67°F. The mean annual temperature is 44 to 50°F. The frost-free season is 110 to 140 days. Some rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Brantel(T), Cowtrack(T), and Zono(T) soils. Brantel soils are alluvial and are ashy throughout the textural control section. Cowtrack soils have ashy over loamy control sections and frigid soil temperature regimes. Zono soils have ashy over loamy control sections.

Drainage and Permeability: Well drained; slow runoff; moderately slow permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly big sagebrush, singleleaf pinyon, desert needlegrass, Indian ricegrass, green Mormon tea, antelope bitterbrush, Douglas rabbitbrush, sulfur buckwheat, little horsebrush, Utah juniper, annual forbs, and perennial forbs.

Distribution and Extent: Mountainous uplands east of the Sierra Nevada in east-central California. The soils are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Pizona Creek.

Remarks: Pizona soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

ROVANA SERIES

The Rovana series consists of very deep, somewhat excessively drained soils. Rovana soils are on alluvial fans, fan terraces, and valley floors. Slopes are 5 to 15 percent. The mean annual precipitation is 8 to 12 inches, some as snow, and the mean annual temperature is 47 to 54°F.

Taxonomic Class: Sandy, mixed, mesic Xeric Torriorthents

Typifying Pedon: Rovana gravelly loamy coarse sand - on a 7 percent southeast slope at 5,650 feet elevation under big sage and desert bitterbrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/25/79) the soil was dry throughout.

30 percent of the soil surface is covered with fine granitic pebbles.

A1--0 to 3 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grained and weak subangular blocky structure (under shrubs); loose and soft, loose and very friable, nonsticky and nonplastic; many very fine and medium roots; many very fine interstitial pores; 20 percent pebbles; neutral (pH 6.6); clear smooth boundary. (2 to 3 inches thick)

A2--3 to 12 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine and medium roots; many very fine interstitial pores; 20 percent pebbles; neutral (pH 6.6); diffuse smooth boundary. (6 to 12 inches thick)

C1--12 to 46 inches; pale brown (10YR 6/3) gravelly coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; 1 percent cobbles, 30 percent pebbles; numerous very gravelly strata present, 1 to 3cm thick containing 35 to 60 percent fine granitic gravel; neutral (pH 6.6); clear wavy boundary. (20 to 38 inches thick)

C2q--46 to 60 inches; pale brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) moist; massive; slightly hard to very hard and weakly silica-cemented in some parts, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent pebbles; slightly acid (pH 6.5).

Type Location: Inyo County, California. About 6 miles west-southwest of the Manzanar Airport; 20 feet north of dirt road; in SW¼NE¼SW¼ Sec. 14, T14S, R34E, M.D.B.M.

Range in Characteristics: Base saturation ranges from 90 to 100 percent. The soil between depths of 10 to 40 inches is usually dry from mid-May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. The mean annual soil temperature is 55 to 59°F. In some areas the soil contains up to 45 percent rhyolitic volcanic ash by weight. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 5/2, 5/3, 5/4, 6/2, or 6/3 and moist color of 10YR 3/2, 3/3, 4/2, or 4/3. Textures are loamy sand or gravelly loamy coarse sand. Rock fragment content ranges from 5 to 35 percent: 5 to 30 percent gravel, 0 to 5 percent cobbles, and 0 to 3 percent stones. The organic carbon content is 0.35 to 0.60 percent. Dry consistence of the A1 horizon is soft under the shrub canopies and loose between the canopies. Most of the gravel is fine gravel.

The C horizon has dry color of 10YR 5/4 or 6/3, and moist color of 10YR 4/2, 4/3, or 4/2. Textures are gravelly coarse sand, gravelly loamy coarse sand, or loamy coarse sand, with some thin very gravelly lenses present. Most of the gravel is fine gravel. In many pedons the lower C horizon is very cobbly loamy coarse sand. Rock fragment content ranges from 5 to 35 percent consisting of 5 to 30 percent gravel, 0 to 20 percent cobbles, and 0 to 10 percent stones. Some stratification is present in the C horizon.

Geographic Setting: These soils occur on alluvial fans, fan terraces, and valley floors. They formed in alluvium from predominantly granitic rock sources. In some areas, a considerable amount of rhyolitic volcanic ash is present in the soil. Slopes are 5 to 15 percent. The elevation ranges from 4,800 to 6,200 feet. The mean annual precipitation is 8 to 12 inches, with some as snow. The mean January temperature is about 34°F; the mean July temperature is about 72°F. The mean annual temperature is 47 to 54°F. The frost-free season is 130 to 160 days.

Geographically Associated Soils: These are the Brantel(T), Tuttle(T), and Washoe soils. Brantel soils have ashy particle-size control sections. Tuttle soils have sandy-skeletal particle-size control sections. Washoe soils have loamy-skeletal argillic horizons and mollic epipedons.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: At present used for grazing, wildlife habitat, and some recreation. The vegetation is mainly big sage, desert bitterbrush, Douglas rabbitbrush, rubber rabbitbrush, California buckwheat, Indian ricegrass, Nevada bluegrass, perennial forbs, annual forbs, bottlebrush squirreltail, green Mormon tea, Nevada ephedra, and desert needlegrass.

Distribution and Extent: Alluvial fans, fan terraces, and valley floors east of the Sierra Nevada in California. The soils are of small extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after the community of Rovana.

Remarks: Rovana soils have an aridic moisture regime that borders on xeric. Cold soil temperatures in winter prevent them from meeting all the xeric moisture regime requirements.

SAWAVU SERIES

The Sawavu series consists of moderately deep, somewhat excessively drained soils with duripans. Sawavu soils are on low fan terraces of ashy alluvium. Slopes are 2 to 9 percent. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is about 48°F.

Taxonomic Class: Ashy, mesic Haploxerollic Durorthids

Typical Pedon: Sawavu gravelly loamy sand - on a 6 percent east facing slope at 5,580 feet elevation under big sagebrush, Nevada dalea, and Nevada ephedra vegetation. Colors are for dry soil unless otherwise stated. When described (8/11/79) the soil was dry throughout.

A1--0 to ½ inch; light brownish gray (10YR 6/2) gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 25 percent pumice pebbles; mildly alkaline (pH 7.8); abrupt smooth boundary. (½ to 1 inch thick)

A2--½ to 3 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grain but massive under shrub canopies; loose and soft, loose and very friable, nonsticky and nonplastic; many very fine interstitial pores; 5 percent fine and medium pumice pebbles; mildly alkaline (pH 7.8); abrupt smooth boundary. (2 to 4 inches thick)

C1--3 to 24 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium and common very fine roots; many very fine interstitial pores; 5 percent fine and medium pumice pebbles; mildly alkaline (pH 7.8); abrupt wavy boundary. (16 to 38 inches thick)

Cq--24 to 50 inches; light gray (10YR 7/2) fractured and discontinuous, silica-cemented duripan, pale brown (10YR 6/3) moist; strong medium, coarse, and very coarse platy structure with lenses of loamy sand present; very hard and extremely hard, very firm and extremely firm; few very fine and fine roots in soil pockets; 25 percent fine and medium pumice pebbles; average fracture spacing greater than 6 in., 2mm thick laminar opal cap; strongly effervescent, lime occurring as common very fine vertical seams; mildly alkaline (pH 7.8); gradual wavy boundary. (10 to 30 inches thick)

C2--50 to 60 inches; light gray (10YR 7/2) loamy sand, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 10 percent fine and medium pumice pebbles; mildly alkaline (pH 7.8)

Type Location: Mono County, California. About 2 miles northeast of Benton Hot Springs; 50 feet southeast of main dirt road and 10 feet southeast of faint secondary road; in the NW¼SE¼SW¼ Sec. 25, T1S, R31E, M.D.B.M.

Range in Characteristics: Depth to the platy duripan ranges from 20 to 40 inches. The soil is usually dry in all parts from mid-May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to

November 30. Summer thunderstorms occur, but they are sporadic and usually do not wet the control section. The mean annual soil temperature is 52 to 56°F. Fine and medium pumice gravel covers 15 to 40 percent of the soil surface. Base saturation is 90 to 100 percent throughout the profile. Ash content is 60 to 90 percent by weight. The dry bulk density of the soil ranges from 1.1 to 1.25 g/cc, and the moist bulk density is 1.3 to 1.45 g/cc, excluding the Cq horizon. The soil is neutral or mildly alkaline.

The A horizon has dry color of 10YR 6/2, 6/3, 7/2, or 7/3, and moist color of 10YR 4/2, 4/3, 5/2, or 5/3. Gravel content of the A2 horizon ranges from 5 to 15 percent. This is mostly pumice and obsidian. Organic carbon content is 0.2 to 0.4 percent.

The C horizon has dry color of 10YR 6/4, 7/2, 7/3, or 8/2, and moist color of 10YR 4/4, 5/2, 5/3, 6/2 or 6/3. Gravel content ranges from 5 to 35 percent.

The Cq horizon is platy and fractured. Thickness ranges from 1 to 30 inches. Consistence is quite variable and pockets of loamy sand are present between fractured duripan lenses. A 1 to 3mm thick opal cap is present. Lime is absent in some profiles.

The C1 and C2 horizons are loamy sand or gravelly loamy sand. Some durinodes may be present in the C2 horizon. Faint mottles are present in the C2 horizon in some pedons. Gravel content ranges from 5 to 35 percent.

Geographic Setting: Sawavu soils are on fan terraces at elevations of 5,400 to 7,300 feet. Slopes are 2 to 9 percent. The soils formed in rhyolitic ashy alluvium. The mean annual precipitation is 8 to 10 inches with much of it as snow. Mean annual snowfall is 40 to 100 inches. Mean January temperature is about 32°F; mean July temperature is about 70°F; mean annual temperature is 46 to 50°F. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Brantel(T), Buscones(T), and Wellington soils. Brantel soils lack a duripan. Buscones soils are formed in rhyolitic tuff and lack a duripan. Wellington soils have a hard, shallow duripan and mixed mineralogy.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability above duripan.

Use and Vegetation: Used principally for grazing and wildlife habitat. Vegetation is mainly big sagebrush, Douglas rabbitbrush, rubber rabbitbrush, Nevada ephedra, Indian ricegrass, needle and thread grass, staghorn cholla, spiny hopsage, longspine horsebrush, bottlebrush squirreltail, and annual forbs.

Distribution and Extent: Fan terraces in east-central California. The soils are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: Sawavu is an Indian name associated with the area.

Remarks: Sawavu soils are not Durandepts due to the intergrade moisture regime. They have an aridic moisture regime that borders on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

SEAMAN SERIES

Seaman soils are very deep and well drained. They formed in mixed alluvium on lower alluvial fans. Slopes are 2 to 5 percent. The mean annual precipitation is 4 to 6 inches; the mean annual temperature is 55 to 60°F.

Taxonomic Class: Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents

Typical Pedon: Seaman loamy sand - on a 2 percent west slope at 4,280 feet elevation under shadscale and Fremont dalea vegetation. Colors are for dry soil unless otherwise stated. When described (8/78) the soil was dry throughout.

10 percent of the soil surface is covered with fine pebbles.

A1--0 to 3 inches; light gray (10YR 7/2) loamy sand, light olive brown (2.5Y 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent pebbles; moderately alkaline (pH 8.0); clear smooth boundary. (2 to 4 inches thick)

A2--3 to 6 inches; very pale brown (10YR 7/3) sandy loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse platy structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine tubular pores; 1 percent pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (3 to 4 inches thick)

2A3--6 to 9 inches; very pale brown (10YR 7/3) loamy sand, light olive brown (2.5Y 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 1 percent pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (3 to 5 inches thick)

3C1--9 to 27 inches; light gray (2.5Y 7/2) sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; 1 percent pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (5 to 9 inches thick)

4C2--27 to 29 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) moist; weak fine platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 3 inches thick)

5C3--29 to 42 inches; light gray (2.5Y 7/2) sandy loam, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial and common very fine vesicular pores; strongly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt wavy boundary. (8 to 15 inches thick)

6C4--42 to 60 inches; light gray (2.5Y 7/2) stratified loamy sand and sandy loam, light olive brown (2.5Y 5/4) moist; massive and weak fine platy structures; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 3 percent pebbles; strongly effervescent, lime disseminated; moderately alkaline (pH 8.0).

Modal Location: Mono County, California. About 13 miles north of Bishop; 50 feet southwest of dirt road; in the SE¼NW¼NW¼ Sec. 4, T5S, R33E, M.D.B.M.

Range in Characteristics: The soil between depths of 8 and 24 inches is usually dry from early April through November, and is moist in some part the rest of the time. It is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 64°F.

The A horizon has dry color of 10YR 7/2, 7/3, or 2.5Y 7/4, and moist color of 10YR 5/2, 5/3, 2.5Y 5/2, or 5/4. Textures are loamy sand, sandy loam, fine sandy loam, and silt loam. Stratification is usually present. The structure is weak platy or subangular blocky, or the soil is massive. Rock fragments make up 0 to 15 percent of the soil volume: 0 to 15 percent gravel and 0 to 5 percent cobbles. The organic carbon content is about 0.2 percent and is assumed to decrease regularly with depth.

The C horizon has dry color of 10YR 7/2, 7/3, or 2.5Y 7/2, and moist color of 10YR 5/2, 5/3, or 2.5Y 5/4. Textures are sandy loam, fine sandy loam, loamy sand, or silt loam. Stratification is present, but the C horizon usually averages 10 to 18 percent clay after mixing. The soil may be slightly sodic in some areas. Lime ($CaCO_3$) content ranges from 4 to 10 percent by weight. Rock fragments make up 0 to 15 percent of the soil volume: 0 to 15 percent gravel and 0 to 5 percent cobbles.

Geographic Setting: These soils occur on the lower slopes of alluvial fans on the east side of Owens Valley. The parent material is alluvium from granitic, sedimentary, and metamorphic rock sources. The elevation ranges from 3,700 to 4,400 feet. Slopes are 2 to 5 percent. The mean annual precipitation is 4 to 6 inches. The mean January temperature is about 40°F; the mean July temperature is about 80°F. The mean annual temperature is 55 to 60°F. The frost-free season is 150 to 210 days.

Geographically Associated Soils: These are the Yellowrock and Yermo soils. Yellowrock soils have sandy particle-size control sections. Yermo soils have more than 35 percent rock fragments in the particle-size control section.

Drainage and Permeability: Well drained; slow runoff; moderate permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly white bursage, shadscale, allscale saltbush, fourwing saltbush, white burrobush, desert needlegrass, Indian ricegrass, and annual forbs.

Distribution and Extent: Alluvial fans in Owens Valley in eastern California. The soils are of small extent within the inventory area.

SHERWIN SERIES

The Sherwin series consists of shallow and very shallow, well drained soils that formed from hard rhyolitic tuff. Sherwin soils are on gently rolling to rolling ignimbrite flows with slopes of 5 to 15 percent. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is 45 to 53°F.

Taxonomic Class: Loamy, mixed, nonacid, mesic Lithic Xeric Torriorthents

Typical Pedon: Sherwin very cobbly loamy fine sand - on a 6 percent south-southeast slope at 5,360 feet elevation under blackbrush, needleleaf rabbitbrush, and big sagebrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/12/79) the profile was dry throughout.

The soil surface is covered with 20 percent pebbles, 20 percent cobbles, and 1 percent stones.

A1--0 to 3 inches; light gray (10YR 7/2) very cobbly loamy fine sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 1 percent stones, 20 percent cobbles, and 20 percent pebbles (tuff fragments); neutral (pH 6.8); abrupt smooth boundary. (1 to 5 inches thick)

A2--3 to 7 inches; light gray (10YR 7/2) sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic, common very fine roots; many very fine vesicular pores; 1 percent stones, 5 percent cobbles, and 5 percent pebbles (tuff fragments); neutral (pH 6.8); abrupt wavy boundary. (3 to 10 inches thick)

R--7 inches; pinkish white (7.5YR 8/2) hard rhyolitic tuff, light brown (7.5YR 6/4) moist. Fracture spacing averages 6 inches.

Type Location: Mono County, California. About 13 miles northwest of Bishop and 1 mile south of Mesa Camp; between two sharp southerly drainages; at the southwest corner of the NW¼SE¼SE¼ Sec. 21, T5S, R31E, M.D.B.M.

Range in Characteristics: Depth to the hard tuff is 4 to 14 inches. The soil above the lithic contact is usually dry from early May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. The mean annual soil temperature is 50 to 59°F. The soil surface has a 35 to 60 percent coverage of stones, cobbles, and gravel, which are angular tuff fragments. The gravel and cobbles predominate. Surface stone coverage is 0 to 3 percent. These soils contain 40 to 60 percent

rhyolitic volcanic ash. Base saturation is 90 to 100 percent.The soil is neutral or mildly alkaline. Rock fragment content of the control section ranges from 20 to 35 percent,consisting of 0 to 3 percent stones, 15 to 30 percent cobbles, and 5 to 20 percent gravel. These are angular tuff fragments. The organic carbon content is 0.3 to 0.6 percent. The clay content of the textural control section averages 6 to 10 percent.

The A horizon has dry color 10YR 6/3, 7/2, 7/3, or 8/2, and moist color of 10YR 4/3, 5/2, 5/3, or 6/2.

The A1 horizon contains 35 to 50 percent angular rock fragments, consisting of 0 to 3 percent stones, 20 to 35 percent cobbles, and 10 to 20 percent gravel.

The A2 horizon is sandy loam or gravelly sandy loam. It contains 10 to 20 percent angular rock fragments, consisting of 0 to 3 percent stones, 5 to 10 percent cobbles, and 5 to 10 percent gravel.

Geographic Setting: Sherwin soils are on gently rolling to rolling ignimbrite flows with slopes of 5 to 15 percent. The soils formed on hard rhyolitic tuff at elevations of 5,300 to 7,300 feet. Some of the fine-earth material is thought to be of mixed aeolian origin. The mean annual precipitation is 8 to 10 inches, some as snow, and the mean annual temperature is 45 to 53°F. The mean January temperature is about 34°F; the mean July temperature is about 72°F. The frost-free season is 125 to 150 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Brantel(T), Buscones(T), and Wellington soils. Brantel soils are very deep alluvial soils. Buscones soils are moderately deep over soft tuff. Wellington soils have shallow duripans and argillic horizons.

Drainage and Permeability: Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: At present, used for grazing and wildlife habitat. The vegetation is mainly big sagebrush, desert needlegrass, spiny hopsage, Nevada ephedra, Douglas rabbitbrush, Fremont dalea, blackbrush, needleleaf rabbitbrush, desert bitterbrush, perennial forbs, spiny menodora, and annual forbs. Singleleaf pinyon occurs in some areas.

Distribution and Extent: Sherwin soils occur on volcanic formations in east-central California. They are of small extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Sherwin Grade.

Remarks: Sherwin soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

TABOOSE SERIES

The Taboose series consists of very deep, well drained soils that formed on recent lava flows with slopes of 5 to 30 percent. The mean annual precipitation is 6 to 8 inches, and the mean annual temperature is about 55°F.

Taxonomic Class: Cindery, thermic Xeric Torriorthents

Typical Pedon: Taboose very gravelly loamy fine sand - on an 8 percent east slope at 4,250 feet elevation under Nevada ephedra, Fremont dalea, and desert needlegrass vegetation. Colors are for dry soil unless otherwise stated. When described (6/25/79) the soil was dry throughout.

The soil surface is covered with 1 percent stones, 20 percent cobbles, and 40 percent pebbles. Small rock outcrops dot the landscape.

A--0 to 5 inches; brown (10YR 5/3) very gravelly loamy fine sand, very dark grayish brown (10YR 3/3) moist; weak fine subangular blocky structure, soft, very friable, nonsticky and nonplastic; few very fine roots, common very fine interstitial and vesicular pores; 1 percent stones, 15 percent cobbles, and 35 percent pebbles (cinders); neutral (pH 7.3); clear smooth boundary. (2 to 8 inches thick)

C1--5 to 25 inches; pale brown (10YR 6/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common medium roots; common very fine interstitial and tubular pores; 1 percent stones, 5 percent cobbles and 20 percent pebbles (cinders); mildly alkaline (pH 7.5); gradual wavy boundary. (15 to 20 inches thick)

C2--25 to 60 inches; yellowish brown (10YR 5/4) extremely stony heavy loamy fine sand, very dark grayish brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; many very fine interstitial pores; 20 percent stones, 10 percent cobbles, and 40 percent pebbles (cinders); silica coatings on underside of cinders; mildly alkaline (pH 7.5).

Type Location: Inyo County, California. About 4.75 miles south of Big Pine on Crater Mountain lava flow; 100 feet northwest of the northwest corner of the SW¼SW¼ Sec. 9, T10S, R34E, M.D.B.M.

Range in Characteristics: Depth to hard lava is greater than 60 inches and in many areas is probably greater than 10 feet. The soil between depths of 10 and 40 inches averages 35 to 80 percent cinders by volume. They are jagged, irregular in shape, and are somewhat vesicular. The soil is usually dry from the end of April through November, and is moist in some or all parts of the control section the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 60°F. Base saturation is 90 to 100 percent throughout the profile. A surface pavement of stones, cobbles, and gravel cover 35 to 70 percent of the soil surface. Gravel and cobbles predominate. Surface stone coverage ranges from 1 to 3 percent. The soil is neutral or mildly alkaline.

The A horizon has dry color of 10YR 5/3 or 6/3, and moist color of 10YR 3/3 or 4/3. The rock fragment content is 35 to 60 percent: 1 to 3 percent stones, 10 to 20 percent cobbles, and 20 to 40 percent gravel. The organic carbon content is 0.3 to 0.5 percent.

The C horizon has dry color of 10YR 6/3, 5/4, or 4/3, and moist color of 10YR 3/3, 3/4 or 4/3. Textures of the lower C horizon are extremely stony loamy fine sand or very stony loamy fine sand. The rock fragment content of the textural control section averages 35 to 80 percent: 15 to 25 percent stones, 5 to 30 percent cobbles, and 40 to 60 percent gravel.

Geographic Setting: Taboose soils are on gently rolling to steep basalt lava flows at elevations of 3,800 to 5,200 feet. Slopes are 5 to 30 percent. The soils formed in lava flows containing many cinders. Some of the fine-earth material is thought to be of eolian origin. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is 54 to 56°F. The mean January temperature is about 37°F; the mean July temperature is about 76°F. The frost-free season is 175 to 200 days. Lava rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Lubkin(T), Pajuela, and Tinemaha(T) soils. These soils lack cinders. Lubkin soils have coarse-loamy argillic horizons. Pajuela soils have sandy-skeletal control sections. Tinemaha soils have loamy-skeletal argillic horizons.

Drainage and Permeability: Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly Nevada ephedra, desert needlegrass, red brome, Fremont dalea, Indian ricegrass, longspine horsebrush, spiny hopsage, California buckwheat, common winterfat, blackbrush, Cooper goldenbush, needleleaf rabbitbrush, cheatgrass, and annual forbs.

Distribution and Extent: Lava flows east of the Sierra Nevada in California. The soils are of small extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Taboose Creek.

Remarks: Taboose soils have an aridic moisture regime that borders on xeric. Taboose soils mapped in unit 150 are taxadjunct to the Taboose series because they receive less precipitation, are calcareous, and have a slightly different plant community. These differences, however, do not greatly affect use and management.

THIBAU SERIES

The Thibau series consists of very deep, somewhat excessively drained soils on alluvial fans, fan terraces, and valley floors. Slopes are 5 to 30 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 56°F.

Taxonomic Class: Sandy, mixed, thermic Xeric Torriorthents

Typical Pedon: Thibau gravelly loamy coarse sand - on a 7 percent east slope at 4,860 feet elevation under Cooper goldenbush, spiny hopsage, white burrobush, blackbrush, and longspine horsebrush vegetation. Colors are for dry soil unless otherwise stated. When described (2/78) the soil was moist throughout.

30 percent of the soil surface is covered with fine granitic pebbles.

A--0 to 10 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine and coarse roots; many very fine interstitial pores; 15 percent pebbles; mildly alkaline (pH 7.8); clear wavy boundary. (8 to 12 inches thick)

C1--10 to 27 inches; light yellowish brown (10YR 6/4) loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine and coarse roots; many very fine interstitial pores; 10 percent pebbles; mildly alkaline (pH 7.8); gradual wavy boundary (14 to 20 inches thick)

C2--27 to 44 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand with some very gravelly lenses present, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine interstitial pores; 2 percent cobbles, 25 percent pebbles; mildly alkaline (pH 7.8); clear wavy boundary. (14 to 22 inches thick)

C3--44 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 30 percent pebbles, 5 percent cobbles; mildly alkaline (pH 7.8).

Type Location: Inyo County, California. About 4 miles southwest of Lone Pine in Owens Valley; 20 feet north of dirt road; at the center of the NW¼SW¼ Sec. 7, T16S, R36E, M.D.B.M.

Range in Characteristics: The soil between depths of 10 and 40 inches is usually dry from the end of April through November, and is moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 63°F. Soil reaction is neutral or mildly alkaline.

The A horizon has dry color of 10YR 5/3, 6/2, 6/3, 6/4, or 7/3, and moist color of 10YR 3/3, 4/2, 4/3, 4/4, or 5/3. Rock fragment content is 5 to 35 percent consisting of 0 to 3 percent stones and boulders, 0 to 10 percent

cobbles, and 5 to 25 percent gravel. The organic carbon content is 0.2 to 0.4 percent. Textures are loamy coarse sand or gravelly loamy coarse sand.

The C horizon has dry color of 10YR 5/3, 6/2, 6/3, 6/4, or 7/4, and moist color of 10YR 4/3, 4/4, or 5/4. Textures are loamy coarse sand, gravelly loamy coarse sand, very gravelly loamy coarse sand, and very cobbly loamy coarse sand. The 10 to 40-inch control section averages loamy coarse sand or coarser. Some very gravelly or very cobbly lenses are present above a 40-inch depth.

Geographic Setting: Thibau soils are on alluvial fans, fan terraces, and edges of valley floors. Slopes are 5 to 30 percent. The elevation range is 4,000 to 5,500 feet. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is 54 to 58°F. The mean January temperature is about 34°F; mean July temperature is about 72°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Lubkin(T), Pajuela, and Tinemaha(T) soils. Lubkin soils have coarse-loamy argillic horizons. Pajuela soils have sandy-skeletal control sections. Tinemaha soils have loamy-skeletal argillic horizons.

Drainage and Permeability: Somewhat excessively drained; slow or very slow runoff, depending on slope; rapid permeability.

Use and Vegetation: Used for grazing, wildlife habitat, and as a source of road construction material. The vegetation is mainly spiny hopsage, Cooper goldenbush, white burrobush, Nevada ephedra, longspine horsebrush, California buckwheat, blackbrush, Anderson wolfberry, Fremont dalea, desert needlegrass, Indian ricegrass, common winterfat, bud sagebrush, needleleaf rabbitbrush, shadscale, and annual forbs.

Distribution and Extent: Alluvial fans, fan terraces, and valley floors in east-central California. The soils are of small extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Thibau Creek.

Remarks: Thibau soils have an aridic moisture regime that borders on xeric.

TINEMAHA SERIES

The Tinemaha series consists of very deep, well drained soils that formed in granitic alluvium. Tinemaha soils are on moderately to strongly sloping bouldery alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 6 to 8 inches, and the mean annual temperature is about 55°F.

Taxonomic Class: Loamy-skeletal, mixed, thermic Xeralfic Haplargids

Typical Pedon: Tinemaha bouldery loamy coarse sand - on an 8 percent east slope at 4,250 feet elevation under Cooper goldenbush, Nevada ephedra, longspine horsebrush, Fremont dalea, spiny hopsage, and desert needlegrass vegetation. Colors are for dry soil unless otherwise stated. When described (3/27/80) the soil was moist to 20 inches.

Surface coverage of rock fragments: 1 percent boulders, 2 percent stones, 3 percent cobbles, and 20 percent pebbles; ¼ inch platy surface crust.

A1--0 to 1 inch; pale brown (10YR 6/3) bouldery loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 1 percent boulders, 2 percent stones, 3 percent cobbles, and 10 percent fine pebbles; neutral (pH 7.0); abrupt smooth boundary. (0 to 3 inches thick)

A2--1 to 9 inches; pale brown (10YR 6/3) bouldery loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 1 percent boulders, 2 percent stones, 3 percent cobbles, and 10 percent fine pebbles; neutral (pH 7.2); clear wavy boundary. (6 to 10 inches thick)

Bt1--9 to 15 inches; yellowish brown (10YR 5/3) very cobbly sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; few thin clay films in pores and bridging mineral grains; 10 percent stones, 30 percent cobbles, and 10 percent fine pebbles; neutral (pH 7.2); clear wavy boundary. (5 to 7 inches thick)

Bt2--15 to 27 inches; yellowish brown (10YR 5/4) very cobbly sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; common thin clay films on ped faces, in pores, and bridging mineral grains; 10 percent stones, 30 percent cobbles, and 10 percent fine pebbles; neutral (pH 7.2); gradual wavy boundary; (8 to 13 inches thick)

C--27 to 60 inches; pale brown (10YR 6/3) very stony loamy coarse sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonsticky; few very fine roots; many very fine interstitial pores; 20 percent stones, 20 percent cobbles, and 10 percent fine pebbles; neutral (pH 7.2).

Type Location: Inyo County, California. About 6 miles south of Big Pine and one mile west of Fish Springs in Owens Valley; 25 yds northwest of tower on west side of power line road; in the northeast corner of the SE¼NE¼SE¼ Sec. 17, T10S, R34E, M.D.B.M.

Range in Characteristics: These soils are usually dry from the end of April through November, and are usually moist in some or all parts the rest of the time. The soil temperature is 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 63°F. Rock fragments tend to be rounded or have rounded edges. Base saturation is 90 to 100 percent throughout the profile. The surface rock fragment coverage

ranges from 30 to 90 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 30 to 50 percent gravel (mostly fine). Some boulders exceed 6 feet in diameter. The soil is neutral or mildly alkaline.

The A horizon has dry color of 10YR 6/3, 6/4, or 7/3, and moist color of 10YR 4/3, 4/4, or 5/3. Rock fragment content ranges from 15 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 10 to 30 percent gravel. Textures are bouldery or very bouldery loamy coarse sand. The organic carbon content is 0.2 to 0.4 percent. Some areas have a fragile vesicular horizon just below the soil surface.

The Bt horizon has dry color of 10YR 5/3, 5/4, 6/3, 6/4, 7.5YR 5/6, 6/4, 6/6, and moist color of 10YR 3/3, 4/3, 4/4, 7.5YR 4/4, or 4/6. Rock fragment content ranges from 35 to 80 percent with 10 to 50 percent boulders and stones, 10 to 30 percent cobbles, and 10 to 30 percent gravel. Textures are sandy loam or sandy clay loam and are very stony, very cobbly or extremely stony. Clay content is 12 to 35 percent. Faint and distinct mottles are present in some profiles with olive and reddish yellow hues (5Y 4/4, 7.5Y 6/6). Clay films are thin to moderately thick and are few to many.

The C horizon has color of 10YR 6/3, 7/3, or 7.5YR 6/6, and moist color of 10YR 4/3, 5/3, or 7.5YR 4/6. Textures are loamy coarse sand with very stony or extremely stony modifiers. Rock fragment content is similar to the B horizon.

<u>Geographic Setting</u>: Tinemaha soils formed on granitic alluvial fans and fan terraces. Many of these fans and fan terraces are part of long aprons along mountain range fronts. They are dissected with some drainageways and shallow washes. Slopes range from 5 to 15 percent. Elevations range from 4,000 to 5,400 feet. The mean annual precipitation is 6 to 8 inches. The mean January temperature is 35 to 39°F; mean July temperature is 75 to 80°F. The mean annual temperature is 54 to 57°F. The frost-free season is 150 to 200 days.

<u>Geographically Associated Soils</u>: These are the Lubkin(T), Pajuela, Taboose(T), and Thibau(T) soils. Lubkin soils have coarse-loamy argillic horizons. Pajuela soils have sandy-skeletal control sections and lack argillic horizons. Taboose soils lack argillic horizons and are in a cindery family. Thibau soils lack argillic horizons and are sandy in the particle-size control section.

<u>Drainage and Permeability</u>: Well drained; slow runoff; moderately slow permeability.

<u>Use and Vegetation</u>: Used principally for rangeland and wildlife habitat. Vegetation is mainly blackbrush, spiny hopsage, Cooper goldenbush, white burrobush, Nevada ephedra, longspine horsebrush, bud sagebrush, Anderson wolfberry, California buckwheat, needleleaf rabbitbrush, Fremont dalea, Indian ricegrass, annual forbs, perennial forbs, and desert needlegrass. Some areas are dominated by blackbrush while other areas have no blackbrush, because of the fire history of the area.

Distribution and Extent: Alluvial fans and fan terraces on the east side of the Sierra Nevada in California. The soils are of moderate extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Tinemaha Creek.

Remarks: Tinemaha soils have an aridic moisture regime that borders on xeric.

TOQUERVILLE FAMILY

The Toquerville family consists of shallow and very shallow, somewhat excessively drained sandy soils. These soils are on moderately steep to steep hilltops in Owens Valley. Slopes are 15 to 50 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 55°F.

Taxonomic Class: Mixed, thermic Lithic Torripsamments

Reference Pedon: Toquerville family bouldery sand - on a 48 percent northeast slope at 4,800 feet elevation under spiny hopsage, Nevada ephedra, and common winterfat vegetation. colors are for dry soil unless otherwise stated. Then described (6/21/79) the soil was dry throughout.

The soil surface is covered with 5 percent rock outcrops, 5 percent boulders, 10 percent stones, 15 percent cobbles, and 20 percent pebbles.

A--0 to 5 inches; light brownish gray (10YR 6/2) bouldery sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few medium roots; many very fine interstitial pores; 5 percent boulders, 10 percent stones, 15 percent cobbles, and 15 percent pebbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

R--5 inches; hard granodiorite bedrock;

Location: Inyo County, California. About 5 miles west of Bishop, ¼ mile south of house, near hilltop; in the NW¼NW¼NE¼ Sec. 7, T7S, R32E, M.D.B.M.

Range in Characteristics: Depth to the lithic contact is 3 to 20 inches. The soils (above the lithic contact) are usually dry from late April through November, and are moist in some or all parts the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 61°F.

The A horizon has dry color of 10YR 6/2 or 6/3, and moist color of 10YR 4/2 or 4/3. Textures are bouldery, stony, cobbly, or gravelly loamy coarse sand or sand. Structure is weak subangular blocky, massive, or single grain. Rock fragments is 10 to 35 percent, consisting of 0 to 5 percent boulders, 0

to 10 percent stones, 0 to 15 percent cobbles, and 5 to 25 percent gravel. Base saturation is 90 to 100 percent. The soil reaction is neutral or mildly alkaline. The organic carbon content is 0.2 to 0.4 percent.

Geographic Setting: These soils occur on moderately steep to steep hills in Owens Valley. The parent material is residuum weathered from granitic bedrock. The elevation ranges from 4,600 to 5,600 feet. Slopes are 15 to 50 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 55°F. The frost-free season is 150 to 200 days. Rock outcrops are associated with these soils.

Geographically Associated Soils: These are the Whitewolf family soils which are moderately deep to very deep soils occuring on lower hillslopes.

Drainage and Permeability: Somewhat excessively drained; medium runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of spiny hopsage, Nevada ephedra, California buckwheat, Fremont dalea, needleleaf rabbitbrush, desert needlegrass, blackbrush, Cooper goldenbush, bud sagebrush, Indian ricegrass, and annual forbs.

Distribution and Extent: Hills in Owens Valley in east-central California. The soils are of small extent within the inventory area.

TORRIORTHENTS, FRIGID

These soils are shallow to deep, well drained, and have formed in residuum weathered from metasedimentary and metavolcanic rock, or from granitic rock. Slopes are 15 to 50 percent. The mean annual precipitation is 9 to 12 inches and the mean annual temperature is 38 to 43°F.

Reference Pedon: very bouldery coarse sandy loam - on a 47 percent south slope at 9,500 feet elevation under subalpine big sagebrush, curlleaf mountainmahogany, Utah juniper, green Mormon tea, and rubber rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (5/11/78) the soil was moist throughout.

The soil is covered with 30 percent boulders, 10 percent stones, 5 percent cobbles, and 5 percent pebbles.

0--1 to 0 inch; partially decomposed plant litter.

A1--0 to 4 inches; brown (10YR 5/3) very bouldery coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; 30 percent boulders, 10 percent stones, 5 percent cobbles, and 20 percent pebbles; neutral (pH 7.0); clear wavy boundary.

A2--4 to 13 inches; pale brown (10YR 6/3) very bouldery coarse sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots, few coarse roots; common very fine interstitial pores; 30 percent boulders, 10 percent stones, 5 percent cobbles, and 20 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

R--13 inches; hard granitic bedrock.

Location: Inyo County, California. About 9½ miles north-northeast of Lone Pine and 1¼ miles northwest of Mount Inyo on the west slope of the Inyo Mountains; 36° 44' 48" N. Lat., 118° 0' 6" W. Long.

Range in Characteristics: Depth to hard bedrock is 10 to 60 inches. The soils (within the moisture control section) are usually dry from late May to November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 15 to December 1, and is above 8°C from April 30 to November 15. The mean annual soil temperature is 43 to 47°F. Mean summer soil temperatures are 59 to 64°F. The soil surface is covered with a 50 to 90 percent pavement of angular gravel and cobbles where the parent rock is metamorphic, or, in granitic areas, the soil is covered with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent fine gravel. Pedons in granitic areas lack lime.

The A horizon has dry color of 10YR 5/2, 5/3, 6/3, or 7/1, and moist color of 10YR 3/2, 3/3, 4/3, or 5/2. In areas of metamorphic parent rock, textures are gravelly, very gravelly, or extremely gravelly sandy loam. In areas of granitic parent rock, textures are stony, bouldery, very stony, or very bouldery coarse sandy loam or loamy coarse sand. Rock fragment content in metamorphic areas is 15 to 60 percent and this is mainly angular gravel and cobbles. In granitic areas it is 15 to 60 percent with 3 to 50 percent stones and boulders, 5 to 10 percent cobbles, and 10 to 30 percent fine gravel. Organic carbon content is estimated at 0.4 to 0.6 percent. In the Granite Mountain area, these soils have an overburden of rhyolitic volcanic ash about 1 foot thick.

The C horizon, where present, has dry color of 10YR 6/3 or 7/3 and moist color of 10YR 4/3 or 5/3. Textures are similar to the A horizon. In granitic areas, a Cr horizon is usually present.

Geographic Setting: These soils occur on high mountain slopes and plateaus at elevations of 8,000 to 9,600 feet. Slopes are 15 to 50 percent. The soils formed in residuum weathered from granitic or metamorphic rock. The mean annual precipitation is 9 to 12 inches, mostly as winter snowfall, and the mean annual temperature is 38 to 43°F. Total snowfall is estimated at 60 to 90 inches per year. The frost-free season is 75 to 100 days.

Geographically Associated Soils: These are the frigid Haplargids and the Cowtrack(T) soils. The frigid Haplargids have an argillic horizon. Cowtrack soils have about two feet of sandy volcanic ash over residual soils that typically have an argillic horizon.

Drainage and Permeability: Well drained; medium or rapid runoff; moderately rapid or rapid permeability.

Use and Vegetation: Used for wildlife habitat. Vegetation is mainly subalpine big sagebrush, low sagebrush, desert bitterbrush, pinyon pine, curlleaf mountainmahogany, various high altitude buckwheats, Sandberg bluegrass, junegrass, and perennial forbs.

Distribution and Extent: The eastern slope of the Sierra Nevada, the Inyo-White Mountains, and the Granite Mountain area. The soils are of small extent within the inventory area.

TORRIPSAMMENTS

These soils are very deep, somewhat excessively drained, and have formed around cinder cones. Slopes are 15 to 50 percent. The mean annual precipitation is 5 to 10 inches and the mean annual temperature is 47 to 57°F.

Reference Pedon: gravelly coarse sand - on a 25 percent northeast slope at 4,670 feet elevation under Nevada ephedra and Fremont dalea vegetation. Colors are for dry soil unless otherwise stated. When described (6/24/79) the soil was dry throughout.

A--0 to 1 inch; brown (10YR 5/3) gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; no roots; many very fine interstitial pores; 25 percent fine and medium pumice pebbles by volume; neutral (pH 7.3); abrupt smooth boundary.

C--1 to 60 inches; brown (10YR 5/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and few medium roots; 15 percent fine and medium pumice pebbles by volume; mildly alkaline (pH 7.4).

Location: Inyo County, California. About 8½ miles south of Big Pine on Red Mountain; approximately ¼ mile south of dirt road; in the NE¼NW¼SW¼ Sec. 32, T10S, R34E, M.D.B.M.

Range in Characteristics: The dark soil colors are due to the inherent dark color of the parent material. The mineralogy is ashy. The soils (between depths of 10 and 40 inches) are dry from April or May through November, and are moist in some or all parts the rest of the time. The moisture regime is aridic-bordering-on- xeric, or aridic. The mean annual soil temperature is 50 to 60°F, making the soil temperature regime mesic or thermic. The soil contains 15 to 35 percent pumice pebbles by volume. Most of the pebbles are 2mm to 1cm in diameter.

The C horizon has textures of loamy coarse sand or gravelly loamy coarse sand.

Geographic Setting: These soils occur on cinder cones in Owens Valley, the Benton Range, and Negit and Paoha Islands in Mono Lake. The elevation ranges from 4,000 to 6,500 feet. Slopes are 15 to 50 percent. The soils formed in basaltic ash and pumice. The mean annual precipitation is 5 to 10 inches,

some as snow, and the mean annual temperature is 47 to 57°F. The frost-free season is 125 to 200 days.

Geographically Associated Soils: These are the Avalmount(T) and Taboose(T) soils. These soils have loamy-skeletal particle-size control sections and slopes of 5 to 30 percent.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly Nevada ephedra, Fremont dalea, shadscale, perennial grasses, and annual forbs in Owens Valley; in the Benton range and Mono Lake area the vegetation is mainly big sagebrush, various rabbitbrushes, perennial grasses, and annual forbs.

Distribution and Extent: Cinder cones in eastern California. The soils are of small extent within the inventory area.

TUTTLE SERIES

The Tuttle series consists of very deep, somewhat excessively drained soils that formed in granitic alluvium. Tuttle soils are on moderately to strongly sloping bouldery alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 8 to 12 inches, and the mean annual temperature is about 50°F.

Taxonomic Class: Sandy-skeletal, mixed, mesic Xeric Torriorthents

Typical Pedon: Tuttle bouldery loamy coarse sand - on a 7 percent north slope at 5,000 feet elevation under blackbrush, big sagebrush, and Douglas rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (10/12/78) the soil was dry throughout.

Surface coverage of rock fragments: 3 percent boulders, 5 percent stones, 10 percent cobbles, and 25 percent pebbles.

A--0 to 12 inches; brown (10YR 5/3) bouldery loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; many very fine interstitial pores; 3 percent boulders, 5 percent stones, 5 percent cobbles, and 25 percent pebbles; slightly acid (pH 6.5); abrupt wavy boundary. (3 to 14 inches thick)

C1--12 to 27 inches; yellowish brown (10YR 5/4) very stony loamy coarse sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; 5 percent boulders, 20 percent stones, 25 percent cobbles, and 5 percent pebbles; neutral (pH 6.9); abrupt wavy boundary. (8 to 20 inches thick)

C2--27 to 60 inches; light yellowish brown (10YR 6/4) extremely stony loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; hard, friable nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine interstitial pores; 5 percent boulders, 25 percent stones, 20 percent cobbles, and 20 percent pebbles, slightly acid (pH 6.5).

Type Location: Inyo County, California. About 2½ miles southeast of Rovana in Round Valley; thirty feet northeast of dirt power line road; in the NE¼ SW¼NE¼NW¼ Sec. 33, T6S, R31E, M.D.B.M.

Range in Characteristics: These soils are usually dry from mid-May to mid-November, and are usually moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. The mean annual soil temperature is 53 to 59°F. Rock fragments tend to be rounded or have rounded edges. The surface rock fragment coverage ranges from 30 to 90 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 20 to 30 percent gravel. Some boulders exceed 6 feet in diameter. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 5/3, 5/4, 6/2, or 6/4, and moist color of 10YR 3/3, 3/4, 4/2, 4/3 or 4/4. Rock fragment content ranges from 15 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 5 to 25 percent gravel. Textures are bouldery or very bouldery loamy coarse sand. Some profiles have thin fragile layers just below the surface that have vesicular pores. The organic carbon content is 0.3 to 0.6 percent.

The C horizon has dry color of 10YR 5/3, 6/3, 6/4, 7/3, 7/4, or 2.5Y 7/2, and moist color of 10YR 3/3, 4/3, 4/4, 5/3 or 2.5Y 5/2. Rock fragment content ranges from 35 to 80 percent with 10 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 5 to 25 percent gravel. Textures are very or extremely stony loamy coarse sand.

Geographic Setting: Tuttle soils formed on recent bouldery granitic alluvial fans and fan terraces. Many of these fans and fan terraces are part of long aprons along mountain range fronts. They are dissected with some shallow washes and drainageways. Slopes are 5 to 15 percent. Elevations range from 4,800 to 6,400 feet. The mean annual precipitation is 8 to 12 inches, some as snow. The mean January temperature is about 33°F; mean July temperature is about 72°F; mean annual temperature is 47 to 54°F. The frost-free season is 130 to 150 days.

Geographically Associated Soils: These are the Haar Family, Rovana(T), and Washoe soils. Haar Family soils are shallow loamy soils over granitic bedrock. Rovana soils have sandy control sections. Washoe soils have argillic horizons.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used principally for grazing and wildlife habitat. Vegetation is mainly big sagebrush, desert bitterbrush, Douglas rabbitbrush, rubber rabbitbrush, Nevada ephedra, green Mormon tea, blackbrush, spiny hopsage, Indian ricegrass, bottlebrush squirreltail, Nevada bluegrass, annual forbs, perennial forbs, California buckwheat, and desert needlegrass.

Distribution and Extent: Alluvial fans and fan terraces east of the Sierra Nevada in California. The soils are of moderate extent.

Series Proposed: Inyo County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: The series is named after Tuttle Creek.

Remarks: Tuttle soils have an aridic moisture regime that borders on xeric. Cold winter soil temperatures prevent them from meeting all the xeric moisture regime requirements.

TUTTLE VARIANT

Tuttle Variant soils are very deep and well drained. They are on alluvial fans and lake terraces near Crowley Lake and in the Benton Range. Slopes are 0 to 5 percent. The mean annual precipitation is 9 to 12 inches, much of it as snow, and the mean annual temperature is 42 to 48°F.

Taxonomic Class: Loamy-skeletal, mixed, nonacid, mesic Xeric Torriorthents

Typical Pedon: Tuttle Variant sandy loam - on a slope of less than 1 percent at 6,900 feet elevation under big sagebrush, Douglas rabbitbrush, and antelope bitterbrush vegetation. Colors are for dry soil unless otherwise stated. When described (10/31/78) the soil was dry throughout.

10 percent of the soil surface is covered with fine and medium pebbles.

A--0 to 8 inches; pale brown (10YR 6/3) sandy loam, very dark grayish brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; common very fine interstitial pores; 3 percent pebbles; slightly acid (pH 6.1); clear wavy boundary. (5 to 10 inches thick)

2C1--8 to 32 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine angular blocky structure; hard, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine interstitial pores; 35 percent pebbles, 15 percent cobbles; slightly acid (pH 6.1); abrupt smooth boundary. (20 to 30 inches thick)

2C2--32 to 60 inches; light yellowish brown (2.5YR 6/4) sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 2 percent pebbles; neutral (pH 7.0).

Modal Location: Mono County, California. About 2 miles west of Crowley Lake and 4 miles east-northeast of Mammoth Airport; 20 feet northwest of dirt road; near the center of the SW¼SW¼SW¼ Sec. 33, T3S, R29E, M.D.B.M.

Range in Characteristics: The particle-size control section averages 35 to 60 percent rock fragments, mainly gravel and cobbles. The soil between

depths of 8 and 30 inches is usually dry from late May until sometime in November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. The mean annual soil temperature is 47 to 54°F.

The A horizon has dry color of 10YR 5/3 or 6/3. Textures are sandy loam or gravelly sandy loam. Rock fragment content is 2 to 30 percent consisting of 2 to 25 percent gravel and 0 to 10 percent cobbles. Structure is weak subangular blocky, single grain, or massive. The organic carbon content is 0.4 to 0.6 percent.

The C horizon has color of 10YR 5/3, 6/3, or 2.5Y 6/4, and moist color of 10YR 4/3, 4/4, or 2.5Y 4/4. Textures are very gravelly sandy loam, very cobbly sandy loam, or sand. Strata of loamy sand or gravelly sandy loam are present in some areas. Rock fragment content averages 35 to 60 percent consisting of 20 to 60 percent gravel and 0 to 20 percent cobbles. Some strata in the C horizon lack rock fragments. Structure is weak angular blocky, massive, or single grain. The soil reaction is slightly acid to neutral.

Geographic Setting: Tuttle Variant soils are on nearly level to gently sloping alluvial fans and lake terraces near Crowley Lake and in the Benton Range. The parent material is mixed alluvium with much granitic influence. Some of the soils near the Sierran moraines may have formed in glacial outwash. The elevation range is 6,000 to 7,200 feet. The mean annual precipitation is 9 to 12 inches, much of it as snow, and the mean annual temperature is 42 to 48°F. The mean annual January temperature is about 29°F; the mean July temperature is about 66°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Buscones(T) and Cashbaugh(T) soils. Buscones soils are sandy and moderately deep over hard, tuffaceous sandstone or conglomerate. Cashbaugh soils are sandy and shallow over hard, tuffaceous sandstone or conglomerate.

Drainage and Permeability: Well drained; slow runoff; moderately rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly big sagebrush, antelope bitterbrush, Douglas rabbitbrush, green Mormon tea, common pricklygilia, basin wildrye, Indian ricegrass, perennial forbs, and Thurbers needlegrass.

Distribution and Extent: Valleys east of the Sierra Nevada in east-central California. The soils are of small extent within the inventory area.

TYPIC DURORTHIDS

These soils are shallow or very shallow, well drained, and have formed in alluvium from mixed rock sources. Slopes are 5 to 15 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 55 to 59°F.

Reference Pedon: very gravelly sandy loam - on a 5 percent southeast slope at 4,400 feet elevation under shadscale, Fremont dalea, and bud sagebrush vegetation. Colors are for dry soil unless otherwise stated. When described (6/14/79) the soil was dry throughout.

The soil surface is covered with about 50 percent angular pebbles and less than 1 percent angular cobbles.

A1--0 to 1 inch; light gray (10YR 7/2) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine vesicular pores; 50 percent angular pebbles, 1 percent angular cobbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--1 to 5 inches; light gray (10YR 7/2) sandy loam, yellowish brown (10YR 5/4) moist; strong coarse platy structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine vesicular pores; 10 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt wavy boundary.

Ckqm--5 inches; extremely hard duripan, cannot be penetrated with backhoe; massive; continuous 1mm thick opal cap on surface of pan.

Location: Inyo County, California. About 4½ miles east of Bishop; 15 feet northeast of dirt road running NW-SE on ridgetop; in the SE¼SE¼NW¼ Sec. 12, T7S, R33E, M.D.B.M.

Range in Characteristics: Depth to the duripan is 4 to 20 inches. The soils (above the duripan) are dry from mid-April through November, and are moist in some part of the control section the rest of the time. They are not moist for as long as 90 consecutive days, in most years. The soil temperature rarely goes below 8°C. The mean annual soil temperature is 59 to 65°F. The soil has a well developed surface pavement that covers 50 to 80 percent of the soil surface. Surface stone coverage is 0 to 3 percent.

The A horizon has dry color of 10YR 7/2, 7/3, 8/2, or 2.5Y 7/2, and moist color of 10YR 5/3, 5/4, 2.5Y 5/4, or 6/4. Textures are gravelly sandy loam, sandy loam, very gravelly sandy loam, or extremely gravelly sandy loam. Rock fragment content averages 15 to 60 percent, consisting of 0 to 3 percent angular stones, 0 to 10 percent angular cobbles, and 10 to 70 percent angular gravel. A vesicular layer is usually present below the surface pavement. The electrical conductivity is less than 1 mmho/cm and the exchangeable sodium percentage ranges from 1 to 3.

The C horizon has dry color of 10YR 7/2, 7/3, 7/4, 8/1, or 2.5Y 7/2, and moist color of 10YR 5/2, 5/3, 5/4, 7/1, or 2.5Y 5/4. Textures below the duripan are assumed to be very gravelly or extremely gravelly sandy loam.

Geographic Setting: These soils occur on dissected remnants of fan terraces at the base of the White-Inyo Mountains. They occur predominantly on ridgetops. Elevations range from 3,900 to 5,700 feet. The soils formed in gravelly alluvium from mixed rock sources, with metasedimentary alluvium being the primary component. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is 55 to 59°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Entic Durorthids and Yermo soils. The Entic Durorthids have a weaker duripan that is shallow or moderately deep. Yermo soils are very deep alluvial soils that do not have a duripan.

Drainage and Permeability: Well drained; medium runoff; very slow permeability.

Use and Vegetation: Used for limited grazing, recreation (off-road vehicles), and wildlife habitat. Vegetation is mainly shadscale, allscale saltbush, Nevada ephedra, white bursage, Fremont dalea, white burrobush, bud sagebrush, annual forbs, desert needlegrass, desert trumpet, Indian ricegrass, and beavertail pricklypear. Creosotebush grows in the warmer areas (south of Independence).

Distribution and Extent: Terrace remnants of old alluvial fans at the base of the White-Inyo Mountains in Inyo and Mono Counties, California. The soils are of small extent within the inventory area.

VICTORVILLE FAMILY

The Victorville family consists of very deep, well drained soils formed in mixed alluvium on valley flood plains. Slopes are 0 to 2 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is about 58°F.

Taxonomic Class: Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents

Reference Pedon: Victorville family loam - on a slope of less than 1 percent at 3,650 feet elevation under black greasewood, shadscale, and Mojave seablite vegetation. Colors are for dry soil unless otherwise stated. When described (6/27/79) the soil was dry throughout.

10 percent of the soil surface is covered with fine pebbles.

A1--0 to 2 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; strong very coarse platy structure; hard, friable, slightly sticky and slightly plastic; many very fine and common fine vesicular pores; violently effervescent, lime disseminated; very strongly alkaline (pH 9.7); abrupt smooth boundary.

2A2--2 to 12 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; very strongly alkaline (pH 9.3); abrupt smooth boundary.

3C1--12 to 27 inches; light gray (2.5YR 7/2) very fine sandy loam, grayish brown (2.5YR 5/2) moist; strong medium platy structure; hard, firm nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores; violently effervescent, lime disseminated; very strongly alkaline (pH 9.9); clear smooth boundary.

4C2--27 to 51 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; slightly effervescent, lime disseminated; very strongly alkaline (pH 9.6); abrupt smooth boundary.

5C3--51 to 60 inches; light gray (2.5Y 7/2) loamy very fine sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores; strongly alkaline (pH 9.0).

Location: Inyo County, California; 2 miles northwest of Dolomite, 5 miles southeast of Lone Pine in Owens Valley; 50 feet southwest of dirt road; in the SW¼NE¼NE¼ Sec. 5, T16S, R37E, M.D.B.M.

Range in Characteristics: These soils are dry from mid-April through November, and are moist in some part the rest of the time. The moisture control section is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 64°F.

The A horizon is loam, sandy loam, very fine sandy loam, or fine sand. Stratification is present, but the lower part of the horizon is finer than loamy very fine sand. The exchangeable sodium percentage ranges from 15 to 80, and the electrical conductivity is 2 to 30. The boron content is 15 to 30 p.p.m. The A1 horizon usually exhibits the extremes in these three properties.

The C horizon is stratified very fine sandy loam, fine sand, sandy loam, loam, or loamy very fine sand, with lenses of finer material sometimes present. The E.S.P. ranges from 50 to 80, and the electrical conductivity ranges from 4 to 28. The boron content is 10 to 17 p.p.m. The $CaCO^3$ content is less than 5 percent throughout the profile. Some of the sandy strata may contain up to 5 percent fine gravel.

Geographic Setting: These soils are on the flood plain of Owens Valley and Chalfant Valley at elevations of 3,600 to 4,300 feet. Water diversions by L.A.D.W.P. now prevent the periodic flooding of these soils. They have formed in mixed alluvium and have slopes of 0 to 2 percent. Small sand dunes around shrubs are common, along with isolated larger dunes. Small playas are present. The mean annual precipitation is 4 to 6 inches, and the mean annual temperature is 55 to 59°F. The mean January temperature is about 39°F; the mean July soil temperature is about 80°F. The frost-free season is 175 to 225 days.

Geographically Associated Soils: These are the Villa family soils. Villa family soils are sandy in the particle-size control section.

Drainage and Permeability: Well drained; very slow or ponded runoff; moderate permeability (due to sodium).

Use and Vegetation: At present, used for limited grazing. Some areas have been converted to irrigated pasture. The vegetation is mainly salt and sodium-tolerant shrubs and grasses consisting of black greasewood, shadscale, allscale saltbush, Mojave seablite, Parry saltbush, white bursage, inland saltgrass, and Indian ricegrass.

Distribution and Extent: Low floodplain of the Owens and Chalfant Valleys in eastern California; the soils are of small extent within the inventory area.

VILLA FAMILY

The Villa family series consists of very deep, well drained soils formed in mixed alluvium on valley flood plains. Slopes are 0 to 2 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is about 59°F.

Taxonomic Class: Sandy, mixed, thermic Typic Torrifluvents

Reference Pedon: Villa family sand - on a slope of less than 1 percent at 3,700 feet elevation under white bursage, shadscale, and black greasewood vegetation. Colors are for dry soil unless otherwise stated. When described (6/12/78) the soil was dry throughout.

A1--0 to 4 inches; light gray (10YR 7/2) sand, grayish brown (2.5YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent fine pebbles; strongly effervescent, lime disseminated; very strongly alkaline (pH 9.3); abrupt smooth boundary.

A2--4 to 17 inches; light gray (10YR 7/2) fine sand, grayish brown (2.5YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 2 percent fine pebbles; very strongly alkaline (pH 9.6); abrupt smooth boundary.

2C1--17 to 21 inches; light gray (10YR 7/1) silt loam, grayish brown (2.5Y 5/2) moist; massive; soft, friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine interstitial pores; violently effervescent, lime disseminated; very strongly alkaline (pH 9.7); abrupt smooth boundary.

3C2--21 to 39 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few medium roots; many very fine interstitial pores; strongly effervescent, lime disseminated; very strongly alkaline (pH 9.5); abrupt wavy boundary.

4C3--39 to 42 inches; light gray (10YR 7/2) coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and few medium roots; many very fine interstitial pores; 5 percent fine pebbles; strongly effervescent, lime disseminated; very strongly alkaline)pH 9.2); abrupt wavy boundary.

5C4--42 to 54 inches; light gray (10YR 7/2) fine sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly effervescent, lime disseminated; very strongly alkaline (pH 9.1); abrupt smooth boundary.

6C5--54 to 63 inches; white (10YR 8/1) silt loam, light olive gray (5Y 6/2) moist; massive; hard, firm, nonsticky and slightly plastic; few very fine interstitial pores; very strongly alkaline (pH 9.1).

Location: Inyo County, California. About 2.75 miles northwest of Dolomite in Owens Valley; 100 feet northeast of Highway 190; in the SW¼SW¼NW¼ Sec. 5, T16S, R37E, M.D.B.M.

Range in Characteristics: These soils are dry from mid-April through November, and are moist in some part of the moisture control section the rest of the time. They are not moist for as long as 90 consecutive days, in most years. The soil temperature rarely goes below 8°C. The mean annual soil temperature is 59 to 64°F.

The A horizon has textures of sand, fine sand, or coarse sand. In many areas it is well sorted by the wind. Stratification is present in some pedons. The electrical conductivity of the saturation extract ranges from 2 to 8 mmhos/cm, and the exchangeable sodium percentage ranges from 15 to 50. The boron content is 10 to 20 ppm. The soil contains 0 to 5 percent fine gravel.

The C horizon is stratified sand, loamy sand, fine sand, coarse sand, silt loam, or sandy loam. The average texture of the textural control section is loamy sand or sand. The soil contains 0 to 5 percent fine gravel. The electrical conductivity of the saturation extract ranges from 2 to 6 mmhos/cm, and the exchangeable sodium percentage ranges from 15 to 80. The boron content is 3 to 20 ppm.

Geographic Setting: These soils are on the flood plain of Owens Valley and Chalfant Valley at elevations of 3,600 to 4,300 feet. Water diversions by L.A.D.W.P. now prevent the periodic flooding of these soils. They have formed in mixed alluvium and have slopes of 0 to 2 percent. Small sand dunes around shrubs are common, along with some isolated larger dunes. The mean annual precipitation is 4 to 6 inches. The mean January temperature is about 39°F; the mean July temperature is about 80°F. The mean annual temperature is 55 to 59°F. The frost-free season is 175 to 225 days.

Geographically Associated Soils: These are the Victorville family soils. Victorville soils have a coarse-loamy particle-size control section.

Drainage and Permeability: Well drained; very slow runoff; moderate permeability.

Use and Vegetation: Used for wildlife habitat. Vegetation is mainly black greasewood, shadscale, allscale saltbush, Mojave seablite, Parry saltbush, inland saltgrass, Indian ricegrass, and white bursage.

Distribution and Extent: Low flood plain of the Owens and Chalfant Valleys in eastern California. The soils are of small extent within the inventory area.

The Washoe series consists of very deep, well drained soils that formed in granitic alluvium. Washoe soils are on moderately to strongly sloping, bouldery alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 8 to 12 inches, and the mean annual temperature is about 50°F.

Taxonomic Class: Loamy-skeletal, mixed, mesic Xerollic Haplargids

Typical Pedon: Washoe bouldery loamy coarse sand - on an 8 percent east slope at 6,070 feet elevation under big sage, desert bitterbrush, Nevada ephedra, and green Mormon tea vegetation. Colors are for dry soil unless otherwise stated. When described (11/29/77) the soil was dry throughout.

Surface coverage of rock fragments: 1 percent boulders, 2 percent stones, 1 percent cobbles, 20 percent fine pebbles; ¼ inch platy surface crust.

A1--0 to 7 inches; grayish brown (10YR 5/2) bouldery loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; 1 percent boulders, 2 percent stones, 1 percent cobbles, and 20 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary. (1 to 8 inches thick)

A2--7 to 20 inches; brown (10YR 5/3) bouldery loamy coarse sand, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; 1 percent boulders, 2 percent stones, and 20 percent pebbles; neutral (pH 7.0); clear wavy boundary. (3 to 15 inches thick)

Bt1--20 to 31 inches; brown (10YR 5/3) very stony sandy loam, dark brown (10YR 3/3) moist; weak coarse angular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; few very fine interstitial and tubular pores; few thin clay films bridging mineral grains; 1 percent boulders, 15 percent stones, 10 percent cobbles, and 10 percent pebbles; neutral (pH 7.0); clear wavy boundary. (6 to 12 inches thick)

Bt2--31 to 44 inches; yellowish brown (10YR 5/4) very stony sandy loam, dark yellowish brown (10YR 3/4) moist; weak coarse angular blocky structure; hard, friable, nonsticky and nonplastic; few very fine and medium roots; few very fine tubular pores; common thin clay films bridging mineral grains; 2 percent boulders, 20 percent stones, 10 percent cobbles, and 10 percent pebbles; neutral (pH 7.0); clear wavy boundary. (12 to 20 inches thick)

C--44 to 60 inches; very pale brown (10YR 7/4) very stony loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; 5 percent boulders, 45 percent stones, and 10 percent pebbles; slightly acid (pH 6.5)

Type Location: Inyo County, California. About 7½ miles west-northwest of Lone Pine; 20 yards southwest of Hogback Creek Road in the S½SE¼NE¼SE¼ Sec. 19, T15S, R35E, M.D.B.M.

Range in Characteristics: These soils are usually dry from early May through November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 53 to 59°F. Rock fragments tend to be rounded or have rounded edges. The surface rock fragment ranges from 20 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 5 to 20 percent gravel. Some boulders exceed six feet in diameter. Base saturation is 90 to 100 percent. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 5/2 or 5/3 and moist color of 10YR 3/2 or 3/3. The rock fragment content is 15 to 60 percent with 3 to 50 percent boulders and stones, 1 to 20 percent cobbles, and 10 to 20 percent gravel. Textures are bouldery or very bouldery loamy coarse sand. The organic carbon content is 0.4 to 0.6 percent.

The B horizon has dry color of 10YR 7/3, 7/4, 6/3, 5/3 or 5/4 and moist color of 10YR 3/3, 3/4, 4/3, or 5/4. It ranges from 18 to 36 inches thick. The rock fragment content ranges from 35 to 75 percent with 3 to 50 percent boulders and stones, 10 to 20 percent cobbles, and 10 to 20 percent gravel. Textures are very stony or extremely stony sandy loam or sandy clay loam. Clay films are thin to moderately thick and are few to many. Some pedons have slight mottling. The clay content ranges from 12 to 25 percent.

The C horizon has dry color of 10YR 7/3 or 7/4. Rock fragment content is similar to the B horizon. Textures are very stony or extremely stony loamy coarse sand, with rock fragment content similar to the B horizon.

Geographic Setting: Washoe soils formed on granitic alluvial fans and fan terraces. These alluvial fans and fan terraces form long aprons along mountain range fronts. They are dissected with some drainageways and shallow washes. Slopes are 5 to 15 percent. Elevations range from 5,100 to 6,500 feet. The mean annual precipitation is 8 to 12 inches, much of it as snow. The mean January temperature is about 33°F; mean July temperature is about 72°F; mean annual temperature is 48 to 53°F. The frost-free season is 130 to 150 days.

Geographically Associated Soils: These are the Rovana(T) and Tuttle(T) soils. These soils lack mollic epipedons and argillic horizons. Rovana soils have sandy control sections. Tuttle soils have sandy-skeletal control sections.

Drainage and Permeability: Well drained; slow runoff; moderately rapid to moderately slow permeability.

Use and Vegetation: Used principally for rangeland, wildlife habitat, and recreation. Vegetation is mainly big sagebrush, desert bitterbrush, Douglas rabbitbrush, Nevada ephedra, green Mormon tea, blackbrush, antelope bitterbrush, desert needlegrass, Indian ricegrass, Nevada bluegrass, perennial forbs, and annual forbs.

Distribution and Extent: Alluvial fans and fan terraces on the east side of the Sierra Nevada. The soils are of small extent within the inventory area.

Series Established: Douglas County, (Carson Valley SCD), Nevada, 1940.

Remarks: This soil is a taxadjunct of the Washoe series because it has a M.A.S.T. of 53 to 59°F, a solum thickness of 23 to 45 inches, a clay content of 12 to 25 percent in the argillic horizon, a frost-free season of 130 to 150 days, and elevations of 5,100 to 6,500 feet.

WASHOE VARIANT

Washoe Variant soils are very deep, well drained soils that formed in granitic alluvium. They are on moderately or strongly sloping alluvial fans and fan terraces. Slopes are 5 to 15 percent. The mean annual precipitation is 8 to 12 inches, and the mean annual temperature is 48 to 53°F.

Taxonomic Class: Fine-loamy, mixed, mesic Xerollic Haplargids

Typical Pedon: Washoe Variant gravelly loamy coarse sand - on a 9 percent east slope at 6,380 feet elevation under big sagebrush, desert bitterbrush, green Mormon tea, rubber rabbitbrush, and scattered singleleaf pinyon vegetation. Colors are for dry soil unless otherwise stated. When described (12/5/77) the soil was dry throughout.

Surface coverage of rock fragments: 1 percent stones, 30 percent pebbles.

A1--0 to 7 inches; brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to single grain; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine interestitial pores; 1 percent stones and 25 percent pebbles; slightly acid (pH 6.5); clear wavy boundary. (3 to 10 inches thick)

A2--7 to 12 inches; brown (10YR 5/3) gravelly light sandy loam, dark brown (10YR 3/3) moist; fine weak subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine, and few coarse roots; few very fine interestitial pores; 1 percent stones, 5 percent cobbles, and 10 percent pebbles; neutral (pH 7.0); clear wavy boundary. (5 to 10 inches thick)

Bt1--12 to 23 inches; yellowish brown (10YR 5/6) gravelly sandy clay loam, dark yellowish brown (10YR 3/6) moist; massive; very hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; many moderately thick clay films in pores and bridging mineral grains; 1 percent stones, 5 percent cobbles, and 10 percent pebbles; neutral (pH 7.0); gradual wavy boundary. (6 to 12 inches thick)

Bt2--23 to 35 inches; yellowish brown (10YR 5/6) cobbly sandy clay loam, dark yellowish brown (10YR 3/6) moist; massive; very hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; many moderately thick clay films in pores and bridging mineral grains; 1 percent stones; 20 percent cobbles, and 10 percent pebbles; neutral (pH 7.0); clear wavy boundary. (8 to 12 inches thick)

Bt3--35 to 41 inches; strong brown (7.5YR 5/6) very cobbly sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky and nonplastic; few very fine tubular and interstitial pores; many thin clay films bridging mineral grains; 5 percent stones; 20 percent cobbles, and 25 percent pebbles; neutral (pH 7.0); clear wavy boundary. (6 to 10 inches thick)

C--41 to 48 inches; strong brown (7.5YR 5/6) very stony light sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine interstitial pores; 25 percent stones, 10 percent cobbles, and 10 percent pebbles; neutral (pH 7.0).

Modal Location: Inyo County, California. About 2.75 miles north of Whitney Portal; 20 yards south of dirt road and approximately 90 yards east of where the dirt road forks; in the NE¼NW¼SE¼ Sec. 13, T15S, R34E, M.D.B.M.

Range in Characteristics: These soils are usually dry from early May through November, and are moist in some or all parts of the moisture control section the rest of the time. The soil temperature is above 5°C from March 15 to December 25, and is above 8°C from April 1 to December 1. The mean annual soil temperature is 53 to 59°F. Rock fragments tend to be rounded or have rounded edges. The surface rock fragment coverage ranges from 20 to 35 percent with 0 to 3 percent stones and boulders, 0 to 10 percent cobbles, and 20 to 30 percent gravel. Many sites have a ¼ inch platy surface crust. The soil is slightly acid to neutral.

The A horizon has dry color of 10YR 5/2, or 5/3, and moist color of 10YR 3/2 or 3/3. The rock fragment content ranges form 15 to 30 percent with 0 to 3 percent boulders and stones, 0 to 10 percent cobbles, and 5 to 30 percent gravel. The organic carbon content is 0.4 to 0.6 percent.

The B horizon has dry color of 10YR 5/3, 5/6, 6/6, or 7.5YR 5/6, and moist color of 10YR 3/4, 4/3, 3/6, or 5/4. The rock fragment content varies from 15 to 30 percent in the upper B and 35 to 50 percent in the lower B horizon. The average rock fragment content for the textural control section is less than 35 percent. Some profiles have weakly effervescent disseminated lime below 10 inches. Clay content averages 20 to 30 percent for the horizon as a whole.

The C horizon has dry color of 7.5YR 5/6, 10YR 7/3, or 7/4, and moist color of 7.5YR 4/4, 10YR 5/4, or 6/4. Rock fragment content is 35 to 60 percent with 10 to 50 percent stones, 10 to 20 percent cobbles, and 5 to 30 percent gravel. Textures are sandy loam or loamy coarse sand. Some horizons have weakly effervescent disseminated lime.

Geographic Setting: Washoe Variant soils formed on alluvial fans and fan terraces. These form long aprons along mountain range fronts. They are dissected with a few drainageways and shallow washes. Slopes are 5 to 15 percent. Elevations range from 5,100 to 6,500 feet. The mean annual precipitation is 8 to 12 inches, much of it as snow. The mean January temperature is about 33°F; mean July temperature is about 72°F; mean annual temperature is 48 to 53°F. The frost-free season is 130 to 150 days.

Geographically Associated Soils: These are the Rovana(T), Tuttle(T), and Washoe soils. Rovana soils have sandy control sections. Tuttle soils have sandy-skeletal control sections. Washoe soils have loamy-skeletal argillic horizons and have bouldery or very bouldery surfaces.

Drainage and Permeability: Well drained; very slow runoff; moderately slow permeability.

Use and Vegetation: Used principally for rangeland, wildlife habitat, and recreation. Vegetation is mainly big sagebrush, desert bitterbrush, Nevada ephedra, green Mormon tea, California buckwheat, blackbrush, and desert needlegrass, with some Cooper goldenbush, longspine horsebrush, and Anderson wolfberry in drier areas.

Distribution and Extent: Alluvial fans and fan terraces in east-central California. The soils are of small extent within the inventory area.

WELLINGTON SERIES

The Wellington series consists of shallow, well drained soils with duripans. They have formed in mixed alluvium. They are on alluvial fans and fan terraces with slopes of 2 to 9 percent. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is 48 to 50°F.

Taxonomic Class: Loamy, mixed, mesic, shallow Xerollic Durargids

Typical Pedon: Wellington very gravelly loamy sand - on a 5 percent east slope at 5,600 feet elevation under big sagebrush, Douglas rabbitbrush, and galleta grass vegetation. Colors are for dry soil unless otherwise stated. When described (8/11/79) the soil was dry throughout.

A1--0 to 1 inch; light gray (10YR 7/2) very gravelly loamy sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores; 1 percent angular stones, 5 percent angular cobbles, and 40 percent angular pebbles; neutral (pH 7.1); abrupt smooth boundary. (1 to 2 inches thick)

A2--1 to 7 inches; light gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; 5 percent angular pebbles, 5 percent angular cobbles, and 1 percent angular stones; neutral (pH 7.1); clear smooth boundary. (4 to 10 inches thick)

Bt--7 to 15 inches; very pale brown (10YR 7/3) sandy clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine and fine tubular pores; many thin clay films on peds and bridging sand grains; 5 percent angular pebbles and 5 percent angular cobbles; mildly alkaline (pH 7.6); abrupt wavy boundary. (5 to 12 inches thick)

Cqm--15 to 18 inches; indurated silica duripan, weak platy structure; hard, very firm; 30 percent pebbles and cobbles; 1mm thick continuous opal cap.

Type Location: Mono County, California. About 5 miles north of Benton Hot Springs; 15 feet west of faint dirt road; in the NE¼NE¼SE¼ Sec. 11, T1S, R31E, M.D.B.M.

Plate 48. Soil profile of Wellington very gravelly loamy sand, northwest of Benton. Note the shallow hardpan at a depth of about 14 inches.

Range in Characteristics: Depth to the duripan is 10 to 20 inches. The soil above the duripan is usually dry in all parts from May through November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from March 15 to December 15, and is above 8°C from April 1 to December 1. The soil surface is covered with a 20 to 50 percent pavement of pebbles, cobbles, and, in some areas, stones. The mean annual soil temperature is 53 to 57°F. Surface stone coverage is 0 to 3 percent.

The A horizon has dry color of 10YR 7/2, 6/3, 6/4, or 5/3, and moist color of 10YR 5/3, 4/2, or 3/3. Angular rock fragments occupy an average of 10 to 35 percent of the lower A horizon: 0 to 3 percent stones, 5 to 15 percent cobbles, and 5 to 15 percent gravel. The thin A1 horizon contains 35 to 60 percent rock fragments. The A horizon contains 20 to 60 percent rhyolitic volcanic ash. The organic carbon content is 0.4 to 0.6 percent.

The Bt horizon has dry color of 10YR 7/3 or 6/4, and moist color of 10YR 4/3, 4/4, or 5/3. Texture is sandy clay loam, or loam, with 18 to 35 percent clay. This horizon contains 5 to 15 percent rock fragments consisting of 0 to 3 percent stones, 0 to 5 percent cobbles, and 5 to 10 percent gravel. Clay films are thin or moderately thick. Soil reaction is neutral or mildly alkaline.

The duripan is hard or very hard, very firm or extremely firm, and is indurated. The duripan has weak platy structure or is massive. In many areas it contains 30 to 60 percent rock fragments. In some areas the duripan appears to have been part of the B horizon which has become indurated.

Geographic Setting: Wellington soils are on old alluvial fans and fan terraces at elevations of 5,600 to 6,800 feet. The parent material is predominantly basaltic and granitic alluvium with some ashy material on the surface. Slopes are 2 to 9 percent. The mean annual precipitation is 8 to 10 inches. Mean annual snowfall is about 30 inches. The mean January temperature is about 34°F; the mean July temperature is about 72°F. The mean annual temperature is 48 to 50. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Brantel(T), Buscones(T), Sawavu, and Sherwin(T) soils. Brantel soils are very deep, ashy, alluvial soils. Buscones soils are ashy and are moderately deep over soft rhyolitic tuff. Sawavu soils have ashy mineralogy and do not have an argillic horizon. Sherwin soils are shallow over hard tuff and lack an argillic horizon.

Drainage and Permeability: Well drained; slow runoff; moderately slow permeability.

Use and Vegetation: At present, used for rangeland and wildlife habitat. The vegetation is mainly big sagebrush, Douglas rabbitbrush, spiny hopsage, Nevada ephedra, galleta grass, desert needlegrass, Indian ricegrass, common winterfat, rubber rabbitbrush, perennial forbs, and annual forbs. Desert bitterbrush is present in the moister areas.

Distribution and Extent: Intermountain valleys in east-central California and Nevada. The soils are of small extent within the inventory area.

Series Established: Lyon County (Smith Valley SCD), Nevada, 1941.

Remarks: This soil is a taxadjunct of the Wellington series because it contains volcanic ash, has very gravelly surface textures, does not have an E horizon (A2 horizon), and is not underlain by silty lacustrine material.

WHITEWOLF FAMILY

The Whitewolf family consists of moderately deep and deep, somewhat excessively drained sandy soils. These soils are on hilly to steep hillsides in Owens Valley. Slopes are 15 to 50 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 55°F.

Taxonomic Class: Mixed, thermic Xeric Torripsamments

Reference Pedon: Whitewolf family coarse sand - on a 30 percent northeast slope at 4,700 feet elevation under longspine horsebrush, white burrobush, spiny hopsage, and Fremont dalea vegetation. Colors are for dry soil unless otherwise stated. When described (6/21/79) the soil was dry throughout.

10 percent of the soil surface is covered with fine and medium pebbles.

A1--0 to 2 inches; light brownish gray (10YR 6/2) coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 5 percent pebbles; neutral (pH 6.8); abrupt smooth boundary.

A2--2 to 18 inches; light brownish gray (10YR 6/2) loamy coarse sand; dark grayish brown (10YR 4/2) moist; massive parting to single grain; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 5 percent pebbles; neutral (pH 7.3); gradual wavy boundary.

C--18 to 43 inches; brown (10YR 5/3) loamy coarse sand, brown (10YR 4/3) moist; massive parting to single grain; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores; 5 percent pebbles and 5 percent cobbles; mildly alkaline (pH 7.7); abrupt irregular boundary.

R--43 inches; hard grandiorite bedrock.

Location: Inyo County, California. About 5 miles west of Bishop; ¼ mile south of dirt road on hillslope; in the NW¼NE¼NE¼ Sec. 7, T7S, R32E, M.D.B.M.

Range in Characteristics: Depth to hard bedrock is 20 to 60 inches. These soils between depths of 10 and 40 inches are usually dry from late April through November, and are moist in some part the rest of the time. The soil temperature is above 8°C from March 1 to December 15, but is rarely below 5°C. The mean annual soil temperature is 59 to 61°F. Base saturation is 90 to 100 percent.

The A horizon has dry color of 10YR 6/2, or 6/3, and moist color of 10YR 4/2 or 4/3. Textures are coarse sand or loamy coarse sand with 5 to 15 percent gravel. The organic carbon content is 0.2 to 0.4 percent.

The C horizon has dry color of 10YR 5/3 or 6/3, and moist color of 10YR 4/3 or 4/4. The soil contains 5 to 15 percent rock fragments consisting of 5 to 10 percent gravel, 0 to 5 percent cobbles, and 0 to 3 percent stones. A Cr horizon is present above a lithic contact in some pedons. The soil reaction is neutral to mildly alkaline.

Geographic Setting: These soils occur on moderately steep to steep hillsides in Owens Valley. The parent material is granitic residuum and colluvium. The elevation ranges from 4,500 to 5,600 feet. Slopes are 15 to 50 percent. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 55°F. The frost-free season is 150 to 200 days.

Geographically Associated Soils: These are the Toquerville family soils. Toquerville family soils are shallow and occur near hilltops.

Drainage and Permeability: Somewhat excessively drained; slow runoff; rapid or very rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of longspine horsebrush, white burrobush, Fremont dalea, spiny hopsage, Nevada ephedra, common winterfat, desert needlegrass, Indian ricegrass, California buckwheat, Cooper goldenbush, annual forbs, and needleleaf rabbitbrush.

Distribution and Extent: Hillsides in Owens Valley in east-central California. The soils are of small extent within the inventory area.

XERALFIC HAPLARGIDS, MESIC

These soils are very deep and well drained. They are on gravelly, stony, or bouldery glacial moraines at the base of the Sierra Nevada. Slopes are 5 to 30 percent. The mean annual precipitation is 7 to 12 inches and the mean annual temperature is about 45 to 51°F.

Reference Pedon: bouldery loamy sand - on a 5 percent southwest slope at 5,120 feet elevation under blackbrush, spiny hopsage, and desert needlegrass vegetation. Colors are for dry soil unless otherwise stated. When described (6/20/79) the soil was dry throughout.

The soil surface is covered with 3 percent boulders, 2 percent stones, 5 percent cobbles, and 30 percent pebbles.

A1--0 to 3 inches; pale brown (10YR 6/3) bouldery loamy sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine interstitial pores; 10 percent pebbles, 5 percent cobbles, 2 percent stones, and 3 percent boulders; mildly alkaline (pH 7.5); abrupt smooth boundary.

A2--3 to 12 inches; very pale brown (10YR 7/3) bouldery sandy loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine vesicular and few very fine interstitial pores; 10 percent pebbles, 10 percent cobbles, 2 percent stones, and 3 percent boulders; mildly alkaline (pH 7.6); clear wavy boundary.

Bt--12 to 31 inches; pale brown (10YR 6/3) very cobbly light sandy clay loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and slightly plastic; many thin and few moderately thick clay films on peds, in pores, and as bridges; few very fine roots; few very fine interstitial and common very fine tubular pores; 20 percent pebbles, 15 percent cobbles, and 5 percent stones; neutral (pH 6.8); clear wavy boundary.

C--31 to 60 inches; pale brown (10YR 6/3) very cobbly loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 20 percent pebbles, 15 percent cobbles, and 5 percent stones; neutral (pH 7.2).

Location: Inyo County, California. About 5½ miles west-southwest of Bishop; 20 feet northeast of dirt road; in the SE¼SE¼SE¼, Sec. 18, T7S, R32E, M.D.B.M.

Range in Characteristics: These soils are usually dry from sometime in May to sometime in November, and are moist in some or all parts of the control section the rest of the time. The soil temperature is above 5°C from late March to late December, and is above 8°C from early April to early December. Three to sixty percent of the soil surface is covered with stones and boulders. In some areas, boulders greater than 10 feet in diameter are present in or on the soil. Base saturation is 90 to 100 percent.

The A horizon has dry color of 10YR 6/2 or 6/3, and moist color of 10YR 4/2 or 4/3. Textures are bouldery, extremely bouldery, very bouldery, stony, very stony, or very gravelly, loamy sand or sandy loam. Structure is subangular blocky or massive. Organic carbon content is estimated at 0.3 to 0.5 percent. Surface boulder and stone coverage is 3 to 30 percent. Some areas have rhyolitic volcanic ash mixed with the granitic till. Rock fragment content varies from 15 to 90 percent: 3 to 60 percent boulders and stones, 5 to 30 percent cobbles, and 20 to 40 percent gravel. Soil reaction is neutral to mildly alkaline.

The B horizon is very cobbly to extremely bouldery sandy clay loam or sandy loam. Structure is subangular blocky or massive. Total rock fragment content is 35 to 80 percent: 3 to 50 percent boulders and stones, 10 to 30 percent cobbles, and 15 to 30 percent gravel.

The C horizon has textures of very cobbly to extremely bouldery loamy sand. Total rock fragment content is 35 to 80 percent: 3 to 60 percent boulders and stones, 10 to 30 percent cobbles, and 15 to 30 percent gravel.

Geographic Setting: These soils are on glacial moraines of the east side of the Sierra Nevada at elevations of 5,100 to 7,200 feet. The glacial moraines have slopes of 5 to 30 percent. The soil formed in glacial till corresponding in age with the Tenaya or Tahoe glacial periods in the Sierra Nevada. The mean annual precipitation is 7 to 12 inches, much of it as snow, and the mean annual temperature is 45 to 51°F. The mean January temperature is about 32°F; the mean July temperature is about 70°F. The frost-free season is 125 to 150 days.

Geographically Associated Soils: These are the Rovana(T) and Tuttle(T) soils. Rovana and Tuttle soils are on alluvial fans and lack argillic horizons.

Drainage and Permeability: Well drained; medium runoff; moderately rapid to moderately slow permeability.

Use and Vegetation: At present, used for grazing and wildlife habitat. The vegetation is mainly big sagebrush, blackbrush, spiny hopsage, desert bitterbrush, antelope bitterbrush, Indian ricegrass, bottlebrush squirreltail, and desert needlegrass. Minor plants are Nevada ephedra and needleleaf rabbitbrush.

Distribution and Extent: Along the escarpment of the eastern Sierra Nevada. The soils are of small extent within the inventory area.

XERIC TORRIORTHENTS

These soils are very deep, well drained, and have formed in volcanic ash and old lakebed sediments. Slopes are 0 to 9 percent. The mean annual precipitation is about 11 inches and the mean annual temperature is about 45°F.

Reference Pedon: light sandy loam - on a 2 percent northeast slope at 6,900 feet elevation under big sage and Douglas rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/13/79) the soil was dry throughout.

A1--0 to 4 inches; light gray (10YR 7/2) light sandy loam, dark brown (10YR 3/3) moist; single grain; loose, nonsticky and nonplastic; many very fine and common fine roots; many very fine interstitial pores; 5 percent fine pebbles; slightly acid (pH 6.3); abrupt smooth boundary.

A2--4 to 20 inches; light gray (10YR 7/2) light sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very few and few fine and medium roots; many very fine interstitial pores; 5 percent fine pebbles; slightly acid (pH 6.3); clear wavy boundary.

C1--20 to 36 inches; light gray (10YR 7/2) light sandy loam, brown (10YR 5/3) nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 5 percent fine pebbles; slightly acid (pH 6.3); abrupt wavy boundary.

2Btb1--36 to 44 inches; pale yellow (5Y 8/3) sandy loam, olive (5Y 5/3) moist; moderate medium platy structure; hard, firm slightly sticky and slightly plastic; common thin clay films in pores and bridging mineral grains; 5 percent fine pebbles; neutral (pH 7.0); abrupt smooth boundary.

2Btb2--44 to 48 inches; white (5Y 8/2) light sandy clay loam, olive (5Y 5/3) moist; moderate medium platy structure; hard, firm, slightly sticky and slightly plastic; common very fine interstitial pores; many moderately thick clay films in pores and bridging mineral grains; 5 percent fine pebbles; mildly alkaline (pH 7.8); abrupt wavy boundary.

3C--44 to 64 inches; white (5Y 8/1) silty clay loam, pale yellow (5Y 7/3) moist; weak medium platy structure; slightly hard, firm, sticky and plastic; common very fine interstitial pores; mildly alkaline (pH 7.8).

Location: Mono County, California. About 2 miles north of Crowley Lake, 100 yds. south of dirt road; in the NW¼NW¼SW¼ Sec. 24, T3S, R29E, M.D.B.M.

Range in Characteristics: Depth to the lakebed sediments is 10 to 40 inches. The soils between depths of 8 and 30 inches are usually dry from late May to November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thundershowers occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is about 50°F.

The A horizon has dry color of 10YR 6/2, 7/1, 7/2, or 7/3, and moist color of 10YR 4/2, 4/3, 5/2, 5/3, or 5/4. Textures are sandy loam or loamy sand. Gravel content is 5 to 15 percent, mostly fine pumice and obsidian gravel. Ash content is estimated at 20 to 60 percent by weight.

The buried B horizon is absent in some pedons.

The C horizon has dry color of 10YR 6/2, 6/3, 7/2, 7/3, 8/1, 2.5Y 7/2, 8/2, 5Y 8/1, 8/2, or 8/3, and moist color of 10YR 4/4, 5/2, 5/3, 7,2, 2.5Y 5/2, 5/4, 6/4, 5Y 5/2, 5/3, or 7/3. Textures are predominantly sandy loam, coarse sandy loam, silt, silt loam, or silty clay loam. Strata of clay or sand are present in some pedons. Clay content ranges from 18 to 35 percent. Stratification is typically present in the C horizon. Diatomaceous strata are present in some areas around Crowley Lake. Gravel content ranges from 0 to 10 percent, mostly fine and medium gravel. Some pedons are slightly effervescent with disseminated lime. The C horizon ranges from unconsolidated to strongly consolidated, but is usually diggable with a spade.

<u>Geographic Setting</u>: These soils occur on remnants of lake terraces around Crowley lake at elevations of 6,800 to 7,000 feet. Slopes are 0 to 9 percent and are nearly level to undulating. The soils formed in rhyolitic volcanic ash and mixed alluvium over stratified lake sediments. The mean annual precipitation is 9 to 11 inches, mostly as snow. The mean annual temperature is about 45°F. The frost-free season is about 125 days.

<u>Geographically Associated Soils</u>: These are the Brantel(T), Cashbaugh(T), and Buscones(T) soils. Brantel soils are very deep, ashy alluvial soils. Cashbaugh soils are shallow over hard, tuffaceous sandstone or conglomerate. Buscones soils are moderately deep over hard, tuffaceous sandstone or conglomerate.

<u>Drainage and Permeability</u>: Well drained; slow to medium runoff; moderate to very slow permeability.

<u>Use and Vegetation</u>: Used for grazing, wildlife habitat, and commercial diatomite mining in some spots. Vegetation is mainly big sagebrush, Douglas rabbitbrush, rubber rabbitbrush, little horsebrush, green Mormon tea, needle and thread grass, western needlegrass, Indian ricegrass, perennial forbs, annual forbs, and some inland saltgrass.

<u>Distribution and Extent</u>: Long Valley area near Crowley Lake in Mono County, California. The soils are of small extent within the inventory area.

XERIC TORRIORTHENTS, ASHY

These soils are very deep, somewhat excessively drained, and have formed in sandy beach deposits. Slopes are 0 to 2 percent. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F.

Reference Pedon: sand - on a 1 percent northwest slope at 6,355 feet elevation under inland saltgrass vegetation. Colors are for dry soil unless otherwise stated. When described (7/77) the soil was dry throughout.

A1--0 to 8 inches; light gray (10YR 7/1) sand, light gray (10YR 6/1) moist; single grain; loose, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine interstitial pores; 2 percent fine pebbles; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

A2--8 to 12 inches; pale yellow (5Y 7/3) sand, olive (5Y 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine interstitial pores; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

2C1--12 to 27 inches; light gray and grayish brown (10YR 7/1, 2.5Y 5/2) stratified silt loam, fine sandy loam, sand, and gravelly sand, gray and very dark grayish brown (10YR 5/1, 2.5Y 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.

3C2--27 to 60 inches; light gray (10YR 7/1) coarse sand, light gray (10YR 6/1) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; slightly effervescent, lime disseminated; strongly alkaline (pH 8.5).

Location: Mono County, California. About 8 miles east of Lee Vining on the shore of Mono Lake, ¼ mile northwest of dirt road; at the southwest corner of the NE¼SW¼ Sec. 11, T1N, R27E, M.D.B.M.

Range in Characteristics: The soils (between depths of 10 and 40 inches) are usually dry from mid-May to November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thunderstorms occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is about 50°F.

The A horizon has dry color of 10YR 6/1, 7/1, or 5Y 7/3, and moist color of 10YR 4/1, 5/1, 6/1, or 5Y 5/3. Textures are sand, coarse sand, gravelly coarse sand, or fine sandy loam. Gravel content ranges from 0 to 20 percent. This is mostly fine pumice gravel. Some pedons do not have carbonates. The fine-earth graction is more than 60 percent rhyolitic volcanic ash.

The C horizon has dry color of 10YR 6/1, 7/1, 2.5Y 5/2, 6/2, or 5Y 6/1, and moist color of 10YR 4/1, 5/1, 6/1, 2.5Y 3/2, 4/2, or 5Y 4/1. Textures are sand, coarse sand, silt loam, fine sandy loam, or gravelly sand. Stratification is present and some of the strata are less than 1 cm thick. Gravel content is 0 to 35 percent. This is mostly fine pumice gravel. Some pedons do not have carbonates. The electrical conductivity of the saturation extract is less than 4 mmhos/cm and the exchangeable sodium percentage is less than 10.

Geographic Setting: These soils occur on the shoreline of Mono Lake at elevations of 6,300 to 6,500 feet. Slopes are 0 to 2 percent with a hummocky surface in some areas. The soils formed in rhyolitic ash alluvium and airfall deposits. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Brantel(T) soils and the Durorthids, ashy. Brantel soils are sandy throughout the textural control section and do not have loamy or very gravelly lenses. The Durorthids have a duripan.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; moderate to moderately rapid permeability.

Use and Vegetation: Used for wildlife habitat and recreation. Vegetation is mainly sparse inland saltgrass with scattered rubber rabbitbrush and Russian thistle.

Distribution and Extent: Lakeshore areas in Mono County, California. The soils are of small extent within the inventory area.

XERIC TORRIORTHENTS, SODIC

These soils are very deep, well drained, and have formed on old lake terraces with slopes of 0 to 9 percent. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual temperature is about 45°F.

Referencee Pedon: silty clay loam - on a 1 percent west slope at 6,440 feet elevation under black greasewood, shadscale, and inland saltgrass vegetation. Colors are for dry soil unless otherwise stated. When described (8/8/79) the soil was dry throughout.

A1--0 to 6 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; strong very coarse platy structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine and fine vesicular pores; violently effervescent, lime disseminated; S.A.R. 15; strongly alkaline (pH 8.8); clear smooth boundary.

A2--6 to 23 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; strong medium and coarse prismatic structure breaking to moderate medium angular blocks; hard, firm, sticky and plastic; common very fine and few fine roots; common very fine interstitial pores; strongly effervescent, lime disseminated; S.A.R. 30; very strongly alkaline (pH 10.8); abrupt smooth boundary.

2C1--23 to 32 inches; white (N 8/0) sand, white (N 8/0) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent fine pebbles; moderately alkaline (pH 8.0); abrupt smooth boundary.

3C2--32 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; strong medium and coarse prismatic structure breaking to moderate medium angular blocks; hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; slightly effervescent, lime disseminated; S.A.R. 36; very strongly alkaline (pH 9.7).

Location: Mono County, California. About 12 miles east-northeast of Lee Vining on the shore of Mono Lake; 8 feet southeast of jeep trail; at the northeast corner of the SW¼SW¼ Sec. 28, T2N, R28E, M.D.B.M.

Range in Characteristics: The soils (between depths of 5 and 16 inches) are usually dry from late May to November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thunderstorms occur, but are sporadic and usually do not wet the control section. The mean annual soil temperature is about 50°F.

The A horizon has dry color of 2.5Y 6/2 or 5Y 6/2, and moist color of 2.5Y 5/2, 4/2, or 5Y 5/2. Textures are silty clay loam or silt loam. A vesicular layer is usually present near the soil surface. The soil reaction is strongly to very strongly alkaline. The electrical conductivity of the saturation extract ranges from 1 to 15 mmhos/cm, and the exchangeable sodium percentage ranges from 15 to 90. Boron content is 2 to 70 ppm.
The C horizon has dry color of 2.5Y 6/2, 5Y 6/2, 7/2, or N 8/0, and moist color of 2.5Y 5/2, 5Y 4/2, 5/2, 6/2 or N 8/0. Textures are silty clay loam or silt loam. The C horizon is stratified with layers of sand. Hard bedrock may occur below depths of 20 inches on Paoha and Negit Islands. The soil reaction is moderately to very strongly alkaline. The electrical conductivity of the saturation extract ranges from 2 to 10 mmhos/cm, and the exchangeable sodium percentage ranges from 15 to 50. Boron content is 2 to 20 ppm.

Geographic Setting: These soils occur on the shoreline of Mono Lake and on islands within the lake. They represent old lake terraces which were at on time under water. Elevations range from 6,400 to 6,700 feet. Slopes are 0 to 9 percent, with undulating or gently rolling surface topography in some areas. The soils formed in stratified lakebed deposits. The mean annual precipitation is 8 to 12 inches, much of it as snow, and the mean annual air temperature is about 45°F. The frost-free season is about 125 days.

Geographically Associated Soils: These are the Alamedawell(T), Brantel(T), and Deepwell(T) soils. Alamedawell soils have 30 to 40 inches of volcanic ash over the lakebed sediments. Brantel and Deepwell soils are ashy throughout the profile.

Drainage and Permeability: Well drained; ponded to rapid runoff, depending on slope; slow or very slow permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is mainly black greasewood, shadscale, inland saltgrass, spiny hopsage, and fourwing saltbush.

Distributuon and Extent: Mono Lake area in eastern California. The soils are of small extent within the inventory area.

XERIC TORRIORTHENTS, VERY BOULDERY

These soils are very shallow to moderately deep and are well drained or somewhat excessively drained. They are on hilly to steep mountainsides with slopes of 15 to 50 percent. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is about 48°F.

Reference Pedon: very bouldery coarse sandy loam - on a 32 percent southeast slope at 6,760 feet elevation under singleleaf pinyon, big sagebrush, and rubber rabbitbrush vegetation. Colors are for dry soil unless otherwise noted. When described (10/4/79) the soil was dry throughout.

0--½ inch to 0; partially decomposed pinyon needles, twigs, and cones.

A--0 to 4 inches; brown (10YR 5/3) very bouldery coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 20 percent boulders and stones, 5 percent cobbles, and 5 percent pebbles; neutral (pH 6.9); clear wavy boundary.

C--4 to 9 inches; yellowish brown (10YR 5/4) very bouldery coarse sandy loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine, fine and coarse roots; common very fine interstitial and few fine tubular pores; 20 percent boulders and stones, 5 percent cobbles, and 10 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.

Cr--9 inches, decomposing granitic bedrock.

Location: Mono County, California. About 1½ miles south of Black Lake in Adobe Valley; 30 yards upslope west of dirt road; in the northwest corner of the NE¼NW¼SW¼ Sec. 8, T2S, R31E, M.D.B.M.

Range in Characteristics: Depth to granitic bedrock is 4 to 40 inches. The soils are usually dry from sometime in May to November, and are moist in some or all parts the rest of the time. The soil temperature is above 5°C from late March to late December, and is above 8°C from early April to early December. Summer thunderstorms occur, but they are sporadic and usually do not wet the control section. The mean annual soil temperature is 47 to 59°F. The soil is slightly acid or neutral.

The A horizon has dry color of 10YR 5/2, 5/3, 6/2, or 7/3, and moist color of 10YR 3/2, 3/3, or 4/3. Textures are loamy coarse sand or coarse sandy loam with bouldery or very bouldery modifiers. The rock fragment content ranges from 15 to 50 percent with 3 to 25 percent boulders and stones, 0 to 10 percent cobbles, and 5 to 15 percent gravel. The soils in the Adobe Valley area and the Benton Range contain considerable quantities of rhyolitic volcanic ash in the A horizon.

The C horizon, where present, has dry color of 10YR 5/4, 7/2, or 6/3, and moist color of 4/3 or 5/2. Textures and rock fragment content are similar

to the A horizon. The horizon is massive or has weak subangular blocky structure.

Geographic Setting: These soils are on hilly to steep mountainsides at elevations of 5,500 to 8,800 feet. Slopes are 15 to 50 percent. The soils formed in material weathered from granitic bedrock. The mean annual precipitation is 8 to 10 inches and the mean annual temperature is 43 to 53°F. The frost-free season is 50 to 150 days.

Geographically Associated Soils: These are the Haar family and Buscones(T) soils. Haar family soils are shallow, loamy soils that do not have as many boulders and stones. Buscones soils are moderately deep over soft rhyolitic tuff and have ashy mineralogy.

Drainage and Permeability: Well drained to somewhat excessively drained; medium to rapid runoff; rapid to moderately rapid permeability.

Use and Vegetation: Used for wildlife habitat. Vegetation is mainly singleleaf pinyon pine, big sagebrush, desert needlegrass, Indian ricegrass, rubber rabbitbrush, desert bitterbrush, green Mormon tea, buckwheats, bottlebrush squirreltail, and annual forbs.

Distribution and Extent: Mountainous areas in Inyo and Mono Counties, California. These soils are of small extent within the inventory area.

XEROLLIC DURORTHIDS

These soils are shallow or moderately deep, well drained, and have formed on alluvial fan terraces with slopes of 2 to 9 percent. The mean annual precipitation is 6 to 8 inches and the mean annual temperature is about 54°F.

Reference Pedon: gravelly loamy coarse sand - on a 3 percent north slope at 4,570 feet elevation under Nevada ephedra, longspine horsebrush, and Fremont dalea vegetation. Colors are for dry soil unless otherwise stated. When described (6/20/79) the soil was very slightly moist below 18 inches.

A1--0 to 5 inches; pale brown (10YR 6/3) gravelly loamy coarse sand, brown (10YR 4/3); moist; weak fine and medium subangular blocky structure, soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; 20 percent pebbles; mildly alkaline (pH 7.5); clear wavy boundary.

A2--5 to 19 inches; pale brown (10YR 6/4) gravelly heavy loamy sand, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial and few very fine tubular pores; 20 percent pebbles; mildly alkaline (pH 7.4); abrupt smooth boundary.

Cq--19 to 24 inches; light yellowish brown (10YR 6/4) gravelly heavy loam sand, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial and few very fine tubular pores; 20 percent pebbles; slight silica cementation present; mildly alkaline (pH 7.4); abrupt smooth boundary.

Cqm--24 inches; light yellowish brown (10YR 6/4) silica-cemented duripan, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, extremely firm; laminar silica cap present.

Location: About 6 miles west of Bishop, 50 feet southwest of dirt road on western edge of excavation; in the SE¼NW¼SW¼ Sec. 31, T6S, R32E, M.D.B.M.

Range in Characteristics: Depth to the duripan is 10 to 40 inches. The soils (above the duripan) are usually dry from April through November, and are intermittently moist in some part the rest of the time. The moisture regime is aridic-bordering-on-xeric. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 60°F. The soil reaction is neutral to mildly alkaline.

The A horizon has dry color of 10YR 6/3, 7/2, or 7/3 and moist color of 10YR 4/3, 5/2, or 5/3. Textures are gravelly loamy coarse sand, loamy sand, or gravelly loamy sand. Gravel content ranges from 5 to 25 percent by volume. Structure of the lower A horizon is usually massive. A single grain or weak subangular blocky surface is present. No carbonates are present. The organic carbon content is 0.2 to 0.4 percent.

The C horizon has dry color of 10YR 6/4, 7/2, 7/3, or 7/4 and moist color of 10YR 4/3, 5/2, or 5/4. The duripan is massive, continuous, and extremely hard and firm. Its thickness is unknown, but is estimated at 1 to 3 feet thick. On the volcanic tablelands, it may be somewhat thinner and occur in plates. In these areas, the soils have ashy mineralogy.

Geographic Setting: These soils occur on old fan terraces at elevations of 4,400 to 5,400 feet. Slopes are 2 to 9 percent. The soils formed in granitic alluvium or a mixture of granitic and ashy alluvium. The mean annual precipitation is 6 to 8 inches, some as snow, and the mean annual temperature is about 54°F. The frost-free season is about 150 days.

Geographically Associated Soils: These are the Chidago(T), Hammil(T), and Honova(T) soils. Chidago soils are formed on soft rhyolitic tuff. Hammil soils lack a duripan. Honova soils are very shallow over hard tuff.

Drainage and Permeability: Well drained; slow runoff; rapid permeability above duripan.

Use and Vegetation: Used for grazing, wildlife habitat, and as a source of roadfill material. Vegetation is mainly Nevada ephedra, Fremont dalea, spiny hopsage, longspine horsebrush, common winterfat, needleleaf rabbitbrush, desert needlegrass, Indian ricegrass, and annual forbs.

Distribution and Extent: Old alluvial fans in northwestern Owens Valley and the volcanic tablelands north of Bishop, in eastern California. The soils are of small extent within the inventory area.

YELLOWROCK SERIES

The Yellowrock series consists of very deep, somewhat excessively drained soils that formed in stratified mixed or granitic alluvium. They are on gently sloping to strongly sloping alluvial fans and fan terraces. Slopes are 0 to 15 percent. The mean annual precipitation is 3 to 6 inches and the mean annual temperature is 55 to 60°F.

Taxonomic Class: Sandy, mixed, thermic Typic Torriorthents

Typical Pedon: Yellowrock loamy sand - on a 3 percent southwest slope at 3,800 feet elevation under white bursage and allscale saltbrush vegetation. Colors are for dry soil unless otherwise stated. When described (8/6/78) the soil was dry throughout.

A1--0 to 4 inches; light gray (2.5Y 7/2) loamy sand, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; 5 percent pebbles; violently effervescent, lime diseminated; moderately alkaline (pH 8.3); clear smooth boundary. (2 to 4 inches thick)

A2--4 to 12 inches; light gray (2.5Y 7/2) light sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine vesicular and few very fine tubular pores; 5 percent pebbles; violently effervescent, lime disseminated; strongly alkaline (pH 8.5); abrupt smooth boundary. (4 to 8 inches thick)

2C1--12 to 19 inches; light gray (2.5Y 7/2) loamy sand, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 5 percent pebbles; violently effervescent, lime disseminated; strongly alkaline (pH 8.7); abrupt wavy boundary. (6 to 10 inches thick)

3C2--19 to 26 inches; light gray (10YR 7/2) gravelly coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and few medium roots; many very fine interstitial pores; 30 percent pebbles and 5 percent cobbles; strongly effervescent, lime disseminated; strongly alkaline (pH 8.6); abrupt smooth boundary. (5 to 8 inches thick)

4C3--26 to 30 inches; light gray (2.5Y 7/2) sand, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; slightly effervescent, lime disseminated; strongly alkaline (pH 8.5); abrupt smooth boundary. (4 to 5 inches thick)

5C4--30 to 38 inches; light gray (2.5Y 7/2) gravelly sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 30 percent pebbles; violently effervescent; lime disseminated; strongly alkaline (pH 9.0); clear wavy boundary. (6 to 9 inches thick)

6C5--38 to 48 inches; light gray (2.5Y 7/2) very cobbly loamy sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 20 percent pebbles and 25 percent cobbles by volume; violently effervescent, lime diseminated; very strongly alkaline (pH 9.2); abrupt wavy boundary. (9 to 14 inches thick)

7C6--48 to 60 inches; light gray (2.5Y 7/2) sand, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores; strongly effervescent, lime disseminated; very strongly alkaline (pH 9.2).

Modal Location: Inyo County, California. About 5½ miles east of Independence; 100 feet south of straight dirt road; in the SW¼SE¼NW¼ Sec. 18, T13S, R36E, M.D.B.M.

Range in Characteristics: The soil between depths of 10 and 30 inches is usually dry from early April through November, and is moist in some part the rest of the time. It is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 64°F. Some pedons are strongly sodic. Lime is absent in areas of granitic alluvium parent material.

The A horizon has dry color of 10YR 7/3, 6/3, 8/1, 2.5Y 7/2, or 5Y 7/2. Moist color is 2.5Y 5/2, 5/4, 10YR 4/3, 5/2, 5/4, or 6/2. Textures are loamy sand, sandy loam, or loamy coarse sand with gravelly textures in some areas. Rock fragment content is 5 to 35 percent, consisting of 5 to 25 percent gravel, 0 to 20 percent cobbles, and 0 to 3 percent stones. Structure is weak subangular blocky, platy, or massive. Some areas have a thin vesicular layer beneath the surface horizon that usually has a sandy loam texture. The organic carbon content is 0.1 to 0.4 percent. The soil is mildly to very strongly alkaline. The electrical conductivity of the saturation extract is 0.5 to 4.0 mmhos/cm and the exchangeable sodium percentage is 1 to 30.

The C horizon has dry color of 2.5Y 7/2, 10YR 7/2, 7/3, 6/3, or 6/4. Moist color is 2.5Y 5/2, 5/3, 5/4, 6/2, 10YR 4/3, 5/2, 5/3, 5/4, 6/2, or 6/3. Textures are loamy sand, sandy loam, loamy coarse sand, or sand. Strata of gravelly, very gravelly, cobbly, very cobbly, stony, or very stony soil is usually present in the lower C horizon. Rock fragment content is 0 to 50 percent: 0 to 25 percent gravel, 0 to 25 percent cobbles, and 0 to 20 percent stones. The 10 to 40 inch control section averages less than 35 percent rock fragments. The electrical conductivity of the saturation extract is 0.5 to 16 mmhos/cm, and the exchangeable sodium percentage is 1 to 90. Areas that are strongly sodic contain up to 30 ppm boron.

Geographic Setting: These soils occur on alluvial fans and fan terraces from granitic or mixed rock sources. The elevation range is 3,600 to 4,500 feet. Slopes are 0 to 15 percent. The mean annual precipitation is 4 to 6 inches, with rare snowfall in some years. The mean January temperature is about 40°F; the mean July temperature is about 80°F. The mean annual temperature is 55 to 60°F. The frost-free season is 200 to 225 days.

Geographically Associated Soils: These are the Arizo, Cajon, Halloran Variant, Seaman, and Yermo soils. Arizo and Yermo soils contain more than 35 percent rock fragments in the particle-size control section. Cajon soils lack loamy or very gravelly strata in the control section. Halloran Variant soils have a natric horizon and deep duripan. Seaman soils have coarse-loamy particle-size control sections.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid or moderately rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation is white bursage, shadscale, allscale saltbush, fourwing saltbush, white burrobush, desert needlegrass, Indian ricegrass, galleta grass, desert trumpet, and annual forbs. Creosotebush is present in some areas. Sodic areas support allscale saltbush, Mojave seablite, shadscale, and black greasewood.

Distribution and Extent: Alluvial fans and fan terraces in Owens Valley in eastern California. The soils are of small extent within the inventory area.

Series Established: BLM Saline Valley Soil Survey, Inyo County, California, 1979.

YERMO SERIES

The Yermo series consists of very deep, well drained soils on alluvial fans. They formed in mixed alluvium and contain many rock fragments. Slopes are 2 to 15 percent. The mean annual precipitation is 4 to 6 inches and the mean annual temperature is about 58°F.

Taxonomic Class: Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents

Typical Pedon: Yermo extremely gravelly sandy loam - on a 14 percent west slope at 4,600 feet elevation under creosotebush, shadscale, and desert trumpet vegetation. Colors are for dry soil unless otherwise stated. When described (6/9/78) the soil was dry throughout.

The soil surface is paved with about 80 percent angular pebbles and 5 percent angular cobbles.

A1--0 to 1 inch; light brownish gray (10YR 6/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; common very fine vesicular pores; 5 percent angular cobbles and 80 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (½ to 1 inch thick)

A2--1 to 4 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, brown (10YR 5/3) moist; weak medium platy structure; soft, friable, nonsticky and nonplastic; common very fine and few fine roots; common very fine and fine vesicular pores; 5 percent angular cobbles, 40 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); clear wavy boundary. (2 to 6 inches thick)

C1--4 to 35 inches; light gray (2.5Y 7/2) very gravelly sandy loam, brown (10YR 5/4) moist; weak fine subangular blocky structure; soft, very friable nonsticky and nonplastic; common very fine and few fine roots; common very fine interstitial pores; 20 percent angular cobbles, 35 percent angular pebbles; violently effervescent, lime disseminated; moderately alkaline (pH 8.0); gradual wavy boundary. (20 to 35 inches thick)

C2--35 to 60 inches; light gray (2.5Y 7/2) very gravelly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 15 percent angular cobbles, 35 percent angular pebbles; violently effervescent, lime disseminated and thin patchy lime pendants on undersides of rock fragments; moderately alkaline (pH 8.0).

Modal Location: Inyo County, California. About 7 miles north of Lone Pine, 30 feet north of dirt road; 36°42'30" N. Lat., 118°2'0" W. Long.

Range in Characteristics: The soil between depths of 10 and 40 inches is dry from early April through November, and is moist in some part the rest of the time. It is not moist for as long as 90 consecutive days, in most years. The soil temperature is rarely below 8°C. The mean annual soil temperature is 59 to 65°F. The soil has a well developed surface pavement that covers 60 to 85 percent of the soil surface. Surface stone coverage is 0 to 5 percent. The soil is moderately to very strongly alkaline.

The A horizon has dry color of 10YR 6/2, 6/3, or 7/2, and moist color of 10YR 4/2, 4/3, 5/2, or 5/3. Textures are very gravelly, extremely gravelly, stony, or extremely cobbly sandy loam. The A horizon contains 35 to 85 percent angular rock fragments consisting of 15 to 80 percent gravel, 5 to 15 percent cobbles, and 0 to 5 percent stones. A vesicular layer is usually present below the surface pavement. The electrical conductivity is 1 to 30 mmhos/cm, and the exchangeable sodium percentage ranges from 1 to 35.

The C horizon has dry color of 10YR 7/2, 7/3, or 2.5Y 7/2, and moist color of 10YR 5/3, 5/4, 2.5Y 5/2, or 5/4. Textures are very gravelly, extremely gravelly, or very cobbly sandy loam. It contains 35 to 80 percent angular rock fragments consisting of 15 to 50 percent gravel, 15 to 40 percent cobbles, and 0 to 5 percent stones. The electrical conductivity of the saturation extract ranges from 1 to 30 mmhos/cm, and the exchangeable sodium percentage ranges from 10 to 95. The boron content is 4 to 120 ppm.

Geographic Setting: Yermo soils are on alluvial fans at elevations of 3,600 to 4,400 feet. Slopes are 2 to 15 percent. The soils formed in mixed alluvium containing much angular gravel and cobbles. The mean annual precipitation 4 to 6 inches, with some of it as snow. The mean January temperature is about 38°F; mean July temperature is about 78°F. The mean annual temperature is about 58°F. The frost-free season is 170 to 225 days.

Geographically Associated Soils: These are the Halloran Variant, Seaman, Taboose, and Yellowrock soils. Halloran Variant soils have a natric horizon and contain less than 35 precent rock fragments in the particle-size control section. Seaman soils have less than 35 percent rock fragement. Taboose soils are cindery and occur on lava flows. Yellowrock soils are sandy and contain less than 35 percent rock fragments in the control section.

Drainage and Permeability: Well drained; medium runoff; moderately rapid permeability.

Use and Vegetation: Used for wildlife habitat and gravel extraction. Vegetation is mainly shadscale, allscale saltbush, white bursage, white burrobush, bud sagebrush, desert needlegrass, Indian ricegrass, annual forbs, desert peach, desert trumpet, beavertail pricklypear, and staghorn cholla. Creosotebush grows in the warmer areas (south of Independence). Saline-sodic areas support allscale saltbush, Mojave seablite, shadscale, and Parry saltbush.

Distribution and Extent: Alluvial fans in Owens Valley and the Mojave Desert. The soils are of moderate extent within the inventory area.

Series Established: San Bernardino County, California; Mojave River Area, 1978.

ZONO SERIES

The Zono series consists of deep, somewhat excessively drained sandy soils. They formed in rhyolitic ash deposited over shallow residual soils. The topography is rolling to steep with slopes of 15 to 50 percent. The mean annual precipitation is about 12 inches and the mean annual temperature is about 45°F.

Taxonomic Class: Ashy over loamy, mixed, nonacid, mesic Xeric Torriorthents

Typical Pedon: Zono coarse sand - on a 38 percent southwest slope at 7,580 feet elevation under big sagebrush and rabbitbrush vegetation. Colors are for dry soil unless otherwise stated. When described (10/19/77) the soil was dry throughout.

A1--0 to 3 inches; light brownish gray (10YR 6/2) coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 10 percent pumice pebbles; slightly acid (pH 6.5); abrupt smooth boundary. (2 to 4 inches thick)

A2--3 to 24 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine, medium, and coarse roots; many very fine interestitial pores; 10 percent pumice pebbles; slightly acid (pH 6.5); gradual wavy boundary. (10 to 28 inches thick)

2C1--24 to 30 inches; light brownish gray (10YR 6/2) gravelly sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 15 percent pebbles, 5 percent cobbles, and 1 percent stones; slightly acid (pH 6.5); abrupt wavy boundary. (4 to 8 inches thick)

3Ab1--30 to 34 inches; pale brown (10YR 6/3) very cobbly sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; 15 percent pebbles, 25 percent cobbles, and 10 percent stones; neutral (pH 7.0); abrupt wavy boundary. (4 to 10 inches thick)

3Ab2--34 to 41 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 15 percent pebbles, 5 percent cobbles, and 1 percent stones; neutral (pH 7.0); gradual wavy boundary. (6 to 10 inches thick)

3Cr--41 inches; weathered granitic bedrock; diggable with spade when dry.

Type Location: Mono County, California. About 13 miles east of Lee Vining near Cowtrack Mountain; 150 feet north-northeast of dirt road; 37°56'36" N. Lat.; 118°52'34" W. Long.

Range in Characteristics: Depth to a lithic or paralithic contact is 40 to 60 inches. The ashy overburden is 24 to 36 inches thick in most areas. The soil between depths of 10 and 40 inches is usually dry from late May to mid-November, and is moist in some or all parts the rest of the time. The soil temperature is above 5°C from April 1 to December 20, and is above 8°C from April 15 to November 30. Summer thunderstorms occur, but they are sporadic and usually do not wet the control section. The mean annual soil temperature is 47 to 52°F. Ash content in the ashy overburden is 60 to 100 percent by weight. Two separate ash deposits are usually present in the ashy overburden. Dry bulk density of the ashy overburden is 1.1 to 1.25 g/cc and moist bulk density is 1.3 to 1.45 g/cc. Base saturation is 90 to 100 percent. The soil reaction is slightly acid to neutral.

The A horizon has dry color of 10YR 6/2, 7/1, 7/2, or 2.5Y 6/2, and moist color of 10YR 4/2, 5/1, 5/2, or 2.5Y 4/2. Textures are loamy sand or coarse sand. The A horizon contains 5 to 15 percent pumice gravel. Most of the gravel is 2mm to 1cm in diameter. The organic carbon content is 0.2 to 0.4 percent.

The C and Ab horizons have dry color of 10YR 6/2, 6/3, 6/4, or 7/2, and moist color of 10YR 4/2, 4/3, 4/4, or 5/2. The C horizon consists of loamy sand or gravelly sand. Rock fragments constitute 15 to 30 percent of the C horizon as a whole: 15 to 20 percent gravel, 0 to 10 percent cobbles, and 0 to 3 percent stones. The textural control section contains an average of less than 35 percent rock fragments. The Ab horizons may contain up to 50 percent rock fragments, and have textures sand, loamy sand, or sandy loam. A buried B horizon is present below the control section in some areas.

Geographic Setting: Zono soils are on hilly to steep uplands at elevations of 6,800 to 8,000 feet. Slopes are 15 to 50 percent. The soils formed in

rhyolitic volcanic ash showered over residual loamy soils from granitic, dacitic, or basaltic bedrock. The mean annual precipitation is 10 to 12 inches, mostly as snow. Mean annual snowfall is 100 to 120 inches. The mean annual temperature is 42 to 46°F. Mean January temperature is about 30°F; mean July temperature is about 67°F. The frost-free season is 100 to 125 days.

Geographically Associated Soils: These are the Cowtrack(T) and Brantel(T) soils. Brantel soils are very deep alluvial soils that lack loamy strata within a depth of 40 inches. Cowtrack soils have frigid soil temperature regimes.

Drainage and Permeability: Somewhat excessively drained; very slow runoff; rapid permeability.

Use and Vegetation: Used for grazing and wildlife habitat. Vegetation consists of big sagebrush, Douglas rabbitbrush, antelope bitterbrush, green Mormon-tea, Indian ricegrass, needle and thread grass, western needlegrass, basin wildrye, blue wildrye, sulfur buckwheat, common pricklygilia, perennial forbs, and annual forbs.

Distribution and Extent: Mountains surrounding Mono Lake in east-central California. The soils are of moderate extent.

Series Proposed: Mono County, California; BLM Benton-Owens Valley Soil Inventory, 1983.

Source of Name: Zono is a Paiute Indian name that is descriptive of the area.

Remarks: Zono soils have an aridic moisture regime bordering on xeric. Cold soil temperatures in winter prevent their meeting all the xeric moisture regime requirements.

GENERAL SOIL MAP UNITS

GENERAL SOIL MAP UNITS

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Eack map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or grazing allotment or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soils of the Saline-Sodic Valley Floors

The two units in this group make up about 5 percent of the inventory area. They occur on basin floors and lower alluvial fans. The soils are poorly drained to well drained, and formed in ashy or mixed alluvium. Many of these soils are saline-sodic. Elevations range from 3,600 to 7,000 feet. The mean annual precipitation is 4 to 12 inches. The mean annual temperature is 45 to 60°F. The frost-free season is 125 to 225 days. These units are used for grazing and wildlife habitat.

1A Aquic Torriorthents - Playa - Aquents

Very deep, nearly level to gently sloping, poorly to somewhat poorly drained ashy loamy sands, sandy loams, and silt loams on basin floors and lake shorelines; calcareous; many saline-sodic soils. This unit occurs in basin floors and depressional areas in Adobe Valley, Long Valley, and Mono Basin. In Adobe and Long Valley, the unit is characterized by imperfectly drained, saline-sodic alluvial soils with slopes of 0 to 2 percent, which are partially overlain by sand dunes. The unit also occurs along the receding shoreline of Mono Lake and Paoha Island. Elevations for the mapping unit range from 6,400 to 7,000 feet. The mean annual precipitation is 8 to 12 inches. The mean annual temperature is about 45°F and the frost-free season is about 125 days. The vegetation is mainly rubber rabbitbrush, inland saltgrass, and black greasewood. This unit occupies 3 percent of the inventory area. It contains about 27 percent Aquic Torriorthents, 17 percent Playa, 11 percent Aquents, and 45 percent sand dunes and other soils. The soils of the unit are used for wildlife habitat and grazing. Sandy textures, saline-sodic condition, and high water tables severely restricts most uses.

The Aquic Torriorthents are at least 60 inches deep and are somewhat poorly drained. They have light colored surfaces which are saline-sodic and calcareous. A high water table is in the lower layers during the spring. Textures are loamy or sandy. The dunes associated with them are not saline-sodic.

Playas are highly saline-sodic, poorly drained, and lack vegetation.

The Aquents are at least 60 inches deep and are poorly or very poorly drained. The profiles are typically stratified with sandy and loamy materials. The surface horizons may be saline-sodic.

1B Victorville family - Villa family - Yermo

Very deep, nearly level to gently sloping, well drained to somewhat excessively drained sands and sandy loams on basin floors, lake shorelines, and lower alluvial fans. This unit occurs on the floor of Owens Valley and Chalfant Valley, Fish Slough, and the alluvial fans along the southeast shore of Owens Lake. The topography is nearly level to gently sloping. Slopes are 0 to 5 percent. The soils have developed in saline-sodic mixed alluvium or aeolian deposits. Elevations range from 3,600 to 4,300 feet. The mean annual precipitation is 4 to 6 inches. The mean annual temperature is 55 to 60°F. The frost-free season is 175 to 225 days. The vegetation is mainly black greasewood, Mojave seablite, shadscale, allscale saltbush, and inland saltgrass. This unit occupies 2 percent of the inventory area. It contains about 25 percent Victorville family soils, 22 percent Villa family soils, 20 percent Yermo soils (saline-sodic phase), and 32 percent other soils and playa areas. The soils of this unit are used for wildlife habitat and very limited grazing. Sandy textures, saline-sodic condition, or high water tables put severe restrictions on many uses of these soils.

The Victorville family soils are at least 60 inches deep and are well drained. They consist of stratified loamy and sandy layers which are strongly saline-sodic and calcareous. The surfaces are loamy and contain fragile vesicular layers.

The Villa family soils are at least 60 inches deep and are somewhat excessively drained. They consist of sandy alluvium or wind deposited dune sand overlying the stratified layers of the Victorville family soils. Much of this dune sand is also strongly saline-sodic and calcareous.

The Yermo soils, saline-sodic phase, are at least 60 inches deep and are well drained. They are loamy and contain many gravel and cobble fragments.

Soils of the Mountainous Regions

The four units in this group make up about 30 percent of the inventory area. They encompass hills and mountains of granitic, basaltic, metasedimentary, and metavolcanic rock. Some areas have been showered with volcanic ash. Drainage is well to somewhat excessive. Elevations range from 3,700 to 11,100 feet. The mean annual precipitation is 4 to 14 inches. The mean annual temperature is 32 to 59°F. The frost-free season is 70 to 200 days. These units are used for grazing, wildlife habitat, mining, and recreation.

2A Lithic Torriorthents - Lithic Haplargids - Rock outcrop

Shallow, moderately steep to very steep, well drained loamy sands, sandy

loams, and silt loams on hills and lower mountain slopes; gravelly, cobbly, stony, or rocky; many calcareous soils. This unit occurs on the lower slopes of the Inyo-White Mountains, Warren Bench, Tungsten Hills, and Sierra Nevada escarpment west of Owens Lake. It also includes the Alabama and Poverty Hills. Topography and relief vary greatly within this unit. Slopes are 30 to 75 percent. The geology consists of granitic, metavolcanic and metasedimentary rocks. Elevations range from 3,700 to 7,000 feet. The mean annual precipitation is 4 to 8 inches. The mean annual temperature is 54 to 59°F. The frost-free season is 150 to 220 days. Vegetation in the drier regions is commonly shadscale and white bursage. In the moister areas spiny hopsage, California buckwheat, needleleaf rabbitbrush, and Nevada ephedra grow. This unit occupies 11 percent of the inventory area. It contains about 44 percent Lithic Torriorthents, 28 percent Lithic Haplargids, 12 percent rock outcrop, and 12 percent deep Torriorthents, other soils and talus debris. This unit is used for grazing, mining, wildlife, habitat, and recreation. Steep slopes, shallow soils, and inaccessibility puts restrictions on many uses.

The Lithic Torriorthents range from 3 to 20 inches deep. These relatively young soils have little horizon development. The surface and subsurface textures are sandy or loamy. Rock fragment content is high in many of these soils. Soil reaction is neutral to moderately alkaline.

The Lithic Haplargids are less than 20 inches deep. These relatively old soils have developed denser subsoils. Surface textures are loamy. Subsoil textures are loamy or clayey. Soil reaction is neutral to moderately alkaline.

Rock outcrops occur in some large bodies in the Inyo Mountains, but for the most part are complexed with the soils in this unit.

2B Xeric Torriorthents, very bouldery - Lithic Xerollic Haplargids - Lithic Xeric Torriorthents

Shallow, hilly to very steep, well drained loamy sands, sandy loams, and loams on higher mountain slopes; gravelly, cobbly, stony, or very bouldery; many calcareous soils. This unit occurs in the Inyo, White, and Sierra Nevada Mountains, as well as the Benton range, Cowtrack Mountain, and the uplands around Adobe Valley. Topography and relief vary greatly within this unit. Slopes are 15 to 75 percent. The geology consists of granitic, metasedimentary, metavolcanic, and volcanic rocks. The soils are medium acid to mildly alkaline. Elevations range from 4,800 to 8,800 feet. The mean annual precipitation is 7 to 10 inches. The average annual temperature is 43 to 54°F. The frost-free season is 110 to 150 days. The vegetation is mainly singleleaf pinyon pine, big sagebrush, and desert bitterbrush. This unit occupies 13 percent of the inventory area. It contains about 25 percent very bouldery Xeric Torriorthents, 23 percent Lithic Xerollic Haplargids, 20 percent Lithic Xeric Torriorthents, and 32 percent rock outcrop, Pizona, Brantel, Haar family, and other soils. The soils of this unit are used for limited grazing, wildlife habitat, and recreation. Steep slopes, shallow soils, and inaccessibility put restrictions on many uses.

The very bouldery Xeric Torriorthents are 4 to 40 inches deep. These relatively young soils have little horizon development. The textures are

sandy or loamy. Many large rock fragments are in these soils.

The Lithic Xerollic Haplargids are 7 to 20 inches deep. These relatively old soils have developed dense subsoils. Surface textures are sandy or loamy. Subsoil textures are loamy or clayey. Rock fragment content is high in many of these soils.

The Lithic Xeric Torriorthents are 7 to 20 inches deep over hard bedrock. Textures are loamy. Rock fragment content is high in many of these soils.

2C Zono - Cowtrack

Deep, gently sloping to steep, somewhat excessively drained ashy sands and loamy sands on higher mountain slopes. This unit occurs on the slopes and high plateau areas of Cowtrack Mountain, southeast of Mono Lake. The soils developed from volcanic ash aerially deposited over shallow soils formed from dacitic or basaltic rock. Slopes are 2 to 50 percent. The Zono soils occur at lower elevations and are warmer than the Cowtrack soils. Elevations range from 5,800 to 9,000 feet. The mean annual precipitation is 10 to 14 inches. The mean annual temperature is 38 to 46°F. The frost-free season is 100 to 125 days. The vegetation is mainly big sagebrush, antelope bitterbrush, rubber rabbitbrush, and Douglas rabbitbrush. This unit occupies 4 percent of the inventory area. It contains about 75 percent Zono soils, 10 percent Cowtrack soils, and 15 percent other soils and rock outcrop. This unit is used for grazing and wildlife habitat. Soft, sandy surfaces make most vehicle travel hazardous. Sandy textures, low available water capacity, limited accessibility, and some steep slopes put restrictions on some uses.

The Zono and Cowtrack soils are 40 to 60 inches deep. Light colored sandy ash overlies loamy subsoils and substrata. The ash layer ranges from 24 to 36 inches deep. Soil reaction is medium acid to neutral. None of these soils are calcareous.

2D Torriorthents, frigid - Haplargids, frigid - Cryoborolls

Shallow to deep, moderately sloping to steep, well drained loamy sands, sandy loams, and silt loams on upper mountain slopes and crests; some calcareous soils; many gravelly, stony, or bouldery. This unit occurs on the upper slopes and crests of the Inyo Mountains and Granite Mountain. It also occurs on the Sierra Nevada escarpment near Crowley Lake. The topography is characteristically rugged and steep. Slopes are 15 to 50 percent. The geology consists of granitic or metasedimentary rock formations. Rock outcrops, stones, and boulders cover much of the granitic areas. Elevations range from 7,000 to 11,100 feet. The mean annual precipitation is 8 to 14 inches. The mean annual temperature is 32 to 43°F. The frost-free season is 70 130 days. The vegetation is mainly singleleaf pinyon pine, curlleaf mountainmahogany, big sagebrush, and rabbitbrushes. Bristlecone pine and limber pine are found at the higher elevations of the Inyo Mountains. This unit occupies about 2 percent of the inventory area. It contains about 30 percent Torriorthents, 25 percent Haplargids, 20 percent Cryoborolls, and 25 percent rock outcrop and other soils. This unit is used for wildlife habitat and recreation. Steep slopes, shallow soils, and limited accessibility restrict many uses.

These soils are 10 to 60 inches deep over granitic or metasedimentary rock. Rock fragment content is high in many of these soils. They have sandy or loamy textures. The subsoil textures of the Haplargids are loamy or clayey. A thin duff layer lies underneath tree canopies. Soils over metasedimentary rocks may be calcareous. Soil reaction is slightly acid to moderately alkaline.

Soils of the Volcanic Tablelands and Old Terraces

The two units in this group make up 17 percent of the inventory area. They include soils on nearly level to rolling formations of volcanic tuff, tuffaceous sandstone, and old alluvium. Many of the soils are ashy. Drainage is well or somewhat excessive. Elevations range from 4,300 to 7,400 feet. The mean annual precipitation is 6 to 13 inches. The mean annual temperature is 43 to 55°F. The frost-free season is 120 to 175 days. These units are used for grazing, wildlife habitat, and as sources of pumice.

3A Honova - Chidago - Hammil

Shallow to very deep, nearly level to strongly sloping, well to somewhat excessively drained ashy loamy sands on volcanic tablelands. Honova soils are very cobbly. This unit occurs on the volcanic tableland area north of Bishop and east of the Benton Range. Rhyolitic volcanic tuff underlies the area. Formations of jointed hard tuff form plateau areas with numerous north-south trending fault scarps. The soils are slightly acid to moderately alkaline. Elevations range from 4,300 to 6,000 feet. The mean annual precipitation is 6 to 8 inches. The mean annual temperature is 50 to 55°F. The frost-free season is 150 to 175 days. The vegetation is mainly shadscale, fourwing saltbush, Fremont dalea, Nevada dalea, little horsebrush, spiny hopsage, needleleaf rabbitbrush, blackbrush, and Nevada ephedra. This unit occupies 15 percent of the inventory area. It contains about 54 percent Honova soils, 21 percent Chidago soils, 14 percent Hammil soils, and 11 percent other soils with duripans, or rock outcrop. This unit is used primarily for grazing, wildlife habitat, and as a source of pumice. Soft, sandy surfaces make most vehicle travel hazardous. Shallow soil depths, sandy textures, and low available water capacity put restrictions on many uses.

The Honova soils are 4 to 14 inches deep. They have sandy surfaces and loamy vesicular subsurface layers. The bedrock is hard rhyolitic tuff. Pavements of cobbles, gravel, and flat stones cover much of the surface.

The Chidago soils are 20 to 40 inches deep. They have sandy, ashy textures throughout the profile. They are underlain by soft rhyolitic tuff with pinkish hues.

The Hammil soils are at least 60 inches deep. They have sandy, ashy textures through the profile, and occur in small valleys on the tablelands.

3B Sherwin - Cashbaugh - Brantel

Mostly shallow, nearly level to moderately sloping, well to somewhat excessively drained ashy loamy sands on volcanic tablelands and lake terraces; many cobbly soils. This unit occurs on the higher elevations of the volcanic tablelands, near Granite Mountain, and on old lake terraces near Crowley Lake. The topography is nearly level to rolling with some steep-sided drainages in some areas. Slopes are 0 to 9 percent. The soils are slightly acid to neutral. Elevations range from 5,300 to 7,400 feet. The mean annual precipitation is 8 to 13 inches. The mean annual temperature is 43 to 50°F. The frost-free season is 120 to 150 days. The vegetation is mainly big sagebrush, blackbrush, desert bitterbrush, and Douglas rabbitbrush. This unit occupies 2 percent of the inventory area. It contains about 36 percent Sherwin soils, 27 percent Cashbaugh soils, 14 percent Brantel soils, and 22 percent other soils and rock outcrop. The soils of this unit are used primarily for grazing and wildlife habitat. Shallow depths and sandy textures restrict many uses of these soils.

The Sherwin soils developed on the upper volcanic tablelands northwest of Bishop. They are 4 to 14 inches deep. A pavement of flat cobbles, stones, and gravel cover much of the sandy surface. The subsurface layer has loamy textures and many vesicular pores. The bedrock is hard rhyolitic tuff.

The Cashbaugh soils developed in alluvium and volcanic ash over tuffaceous sandstone, conglomerate, and hard rhyolitic tuff around Crowley Lake and the Adobe Valley area. They are 10 to 20 inches deep. Some areas have strongly developed surface pavements like the Sherwin soils.

The Brantel soils developed in ashy alluvium in small valleys or depressions within this unit. They at least 60 inches deep and have sandy textures.

Soils of the Intermountain Valleys

The two units in this group make up 17 percent of the inventory area. They include much of the alluvial, aeolian, lake, and airfall volcanic ash deposits which occur in the intermountain valleys of the higher elevations. Drainage is somewhat excessive to excessive. Elevations range from 5,200 to 8,000 feet. The mean annual precipitation is 7 to 12 inches. The mean annual temperature is 46 to 51°F. The frost-free season is 125 to 150 days. These units are used for grazing and wildlife habitat. They are also used as sources for sand, gravel, and pumice.

4A Brantel - Brantel Variant

Very deep, nearly level to rolling, somewhat excessively to excessively drained ashy sands and loamy sands on lake terraces and valley floors; some gravelly textures present. This unit occurs in Mono Basin, Granite Basin, and small valleys in the Cowtrack Mountain area. It also occurs on the terraces around Crowley Lake. The topography is undulating to rolling. Slopes are 2 to 15 percent. The soils formed from airfall ash deposits have been reworked by wind and water. The soils are medium acid to mildly alkaline and are noncalcareous. Elevations range from 6,500 to 8,000 feet. The mean annual

precipitation is 10 to 12 inches. The mean annual temperature is 41 to 46°F. The frost-free season is about 125 days. The vegetation is mainly big sagebrush, antelope bitterbrush, and rubber rabbitbrush. This unit occupies 5 percent of the inventory area. It contains about 74 percent Brantel soils, 7 percent Brantel Variant soils, and 19 percent Cowtrack Variant and other soils with duripans or loamy, saline-sodic lower layers. The soils of this association are used primarily for grazing, wildlife, and as sources of gravel. Soft, sandy ash surfaces make driving of most vehicles hazardous. Sandy textures and low available water capacity put restrictions on some uses of these soils.

The Brantel soils are sandy and are at least 60 inches deep. Some gravelly textures are present.

The Brantel Variant soils are at least 60 inches deep, and occur in the southwest corner of Mono Basin and on terraces overlooking Crowley Lake. These are ashy soils with sandy surfaces and very gravelly lower layers.

4B Brantel - Sawavu - Buscones

Moderately deep to very deep, nearly level to strongly sloping, somewhat excessively drained ashy loamy sands on alluvial fans, lower hill slopes, and valley floors. This unit occurs on the upper volcanic tablelands, on the terraces east of Crowley Lake, and in Adobe, Benton, and Blind Spring Valleys. The topography is nearly level to rolling. Slopes are 0 to 15 percent. Steep-sided drainages dissect some of the sloping areas. The soils formed in airfall ash deposits, ash flows, and ashy alluvium. They are slightly acid to mildly alkaline, and are noncalcareous. Elevations range from 5,200 to 7,300 feet. The mean annual precipitation is 8 to 10 inches. The mean annual temperature is 44 to 51°F. The frost-free season is 125 to 150 days. The vegetation is mainly big sagebrush, Douglas rabbitbrush, Nevada ephedra, Indian ricegrass, spiny hopsage, desert bitterbrush, and desert needlegrass. This unit occupies 12 percent of the inventory area. It contains about 48 percent Brantel soils, 14 percent Sawavu soils, 13 percent Buscones soils, and 25 percent Wellington, Hoye Variant, and other soils. The soils of this unit are used for grazing, wildlife habitat, and as sources of sand and pumice. Loose, sandy surfaces make travel in most types of vehicles hazardous. Sandy textures and low available water capacity put restrictions on some uses of these soils.

The Brantel soils are at least 60 inches deep. They are ashy soils which occur on alluvial fans and valley floors throughout the association. The soil is sandy throughout the profile. Many lower layers are gravelly with pumice and obsidian pebbles.

The Sawavu soils are complexed with the Brantel soils in some areas. They are at least 60 inches deep and have weakly cemented duripans below a depth of two feet. Surface and lower layers are sandy. Many lower layers are gravelly.

The Buscones soils formed from airfall ash deposits and ash flows. These sandy soils are 20 to 40 inches deep. They overlie soft rhyolitic tuff. Many profiles are gravelly with pumice pebbles.

Soils of the Bouldery and Stony Alluvial Fans

The three units in this group make up 29 percent of the inventory area. They include the alluvial fans of the Inyo-White Mountains and the alluvial fans, moraines, and glacial till from the Sierra Nevada. Large rock fragments cover much of the area. Drainage is well or somewhat excessive. Elevations range from 3,600 to 7,100 feet. The mean annual precipitation is 4 to 12 inches. The mean annual temperature is 44 to 60°F. The frost-free season is 125 to 225 days.

5A Yermo - Entic Durorthids - Arizo

Shallow to very deep, nearly level to steep, well or somewhat excessively drained sands and sandy loams on alluvial fans and old terrace remnants; gravelly, cobbly, stony or bouldery; mostly shallow duripans present on terrace remnants; many calcareous soils. This unit occurs on the drier alluvial fans of the Owens and Chalfant Valleys. The topography is nearly level to moderately steep. Slopes are 0 to 50 percent. Old dissected terraces with gently rolling to steep topography occur on the east side of Owens Valley. Elevations range from 3,600 to 5,700 feet. The mean annual precipitation is 4 to 6 inches. The mean annual temperature is 51 to 60°F. The frost-free season is 150 to 225 days. The vegetation is mainly shadscale, creosotebush, allscale saltbush, white bursage, white burrobush, and desert needlegrass. This unit occupies 10 percent of the inventory area. It contains about 29 percent Yermo soils, 22 percent Entic Durorthids, 22 percent Arizo soils, and 27 percent Bitter, Cajon, Garlock Variant, Typic Durorthids, Yellowrock, and Seaman soils. The soils of this unit are used for grazing and wildlife habitat. Surface stoniness or high rock fragment contents restrict many uses of these soils.

The Yermo soils occur on alluvial fans on the east side of Owens Valley. They are at least 60 inches deep and have formed in alluvium from metasedimentary and metavolcanic rock sources. A pavement of gravel, cobbles, and some stones covers much of the surface. Surface and lower layers commonly have loamy textures that are very to extremely gravelly or cobbly.

The Entic Durorthids formed on old dissected terraces on east side of Owens Valley. They are similar to the Yermo soils except that they have shallow or moderately deep duripans.

The Arizo soils occur primarily on the west side of Owens Valley. They are at least 60 inches deep and contain many large rock fragments. They have formed in alluvium from granitic rock sources and have bouldery or very bouldery surfaces. The profiles are sandy and are stony to very bouldery. These soils are mildly alkaline and most are noncalcareous.

5B Pajuela - Tinemaha - Thibau

Very deep, gently to strongly sloping, well or somewhat excessively drained loamy coarse sands on alluvial fans and old terrace remnants; many bouldery or very bouldery; loamy subsoils on older fans. This unit is primarily located on the alluvial fans of the White Mountains and the Sierra

Nevada. Slopes are 2 to 15 percent. The soils are composed of predominantly granitic alluvium. Surface conditions range from nonbouldery to very bouldery. Most of the fans are incised with a few prominent drainages. The soils of these fans are mostly neutral to mildly alkaline and are noncalcareous. The soils of the metasedimentary and metavolcanic fans are mostly mildly to moderately alkaline and are calcareous. Elevations range from 4,000 to 6,000 feet. The mean annual precipitation is 6 to 8 inches. the mean annual temperature is 49 to 57°F. The frost-free season is 140 to 200 days. The vegetation is mainly blackbrush, spiny hopsage, Nevada ephedra, Fremont dalea, needleleaf rabbitbrush, longspine horsebrush, Cooper goldenbush, California buckwheat, white burrobush, and Anderson wolfberry. This unit occupies 13 percent of the inventory area. It contains 54 percent Pajuela soils, 26 percent Tinemaha soils, 11 percent Thibau soils, and 9 percent Lubkin and other soils. The soils of this unit are used for grazing, wildlife, recreation, and as sources of sand and gravel. High content of boulders and stones restrict many uses of these soils.

The Pajuela soils contain many large rock fragments and are at least 60 inches deep. Surface stones and boulders are present, and textures are sandy.

The Tinemaha soils contain many large rock fragments and are at least 60 inches deep. Surface textures are sandy and the dense subsoils are loamy.

The Thibau soils have sandy textures, many of which are gravelly.

5C Tuttle - Rovana - Washoe

Very deep, gently to strongly sloping, well to somewhat excessively drained sands, loamy sands, and sandy loams on alluvial fans and glacial moraines; many bouldery or very bouldery. This unit occurs at the higher elevations on the alluvial fans of the Sierra Nevada and White Mountains. Slopes range from 5 to 15 percent. Some of the alluvial fans are incised with a few prominent, steep-sided drainageways. Most of the soils have developed in granitic alluvium containing many stones, cobbles, and boulders. The soils are slightly acid to mildly alkaline and are noncalcareous. Elevations range from 4,800 to 7,100 feet. The mean annual precipitation is 7 to 12 inches. The mean annual temperature is 44 to 53°F. The frost-free season is 125 to 150 days. The vegetation is mainly big sagebrush, desert bitterbrush, Nevada ephedra, blackbrush, Douglas rabbitbrush, California buckwheat, and green Mormon tea. This unit occupies 6 percent of the inventory area. It consists of 50 percent Tuttle soils, 25 percent Rovana soils, 10 percent Washoe soils, and 20 percent Washoe Variant soils, Dotard soils, and rubbleland. The soils of this unit are used for grazing, wildlife habitat, and recreation. Surface stones and boulders and high rock fragment content restrict many uses.

The Tuttle soils are on granitic alluvial fans and are bouldery or very bouldery. They have sandy textures throughout the profile.

The Rovana soils are sandy and occur on granitic alluvial fans. They contain little or no stones and cobbles, but some areas are gravelly. Textures are sandy.

The Washoe soils are on older granitic alluvial fans and are bouldery or very bouldery. Surface layers are darker-colored and sandy. The subsoils are denser and loamy.

Soils of The Lava Flows

The one unit in this group makes up about 3 percent of the inventory area. It includes the basaltic lava flows and cinder cones. The soils are well drained. Elevations range from 3,800 to 6,600 feet. Precipitation is 5 to 10 inches. The mean annual temperature is 47 to 57°F. The frost-free season is 125 to 200 days. This unit is used for grazing and wildlife habitat.

6A Taboose - Avalmount - Rock outcrop

Very deep, moderately sloping to steep, well drained cindery loamy sands and sandy loams on basaltic lava flows; cobbly, stony, and rocky; some calcareous soils. This unit occurs primarily on the lava flows between Independence and Big Pine in Owens Valley. Small acreages occur in the Benton Range and on the islands of Mono Lake. Crater Mountain south of Big Pine is the most prominent feature in the unit. Typically, the landscape is composed of moderately sloping to steep lava flows projecting down slope from steep sided cinder cones. Slopes are 5 to 30 percent. Jagged cinder rock outcrops dot the flows. Elevations range from 3,800 to 6,600 feet. Precipitation is 5 to 10 inches. The mean annual temperature is 47 to 57°F. The frost-free season is 125 to 200 days. The vegetation is mainly Nevada ephedra, Fremont dalea, California buckwheat, desert needlegrass, big sagebrush, needleleaf rabbitbrush, longspine horsebrush, and shadscale. This unit comprises 3 percent of the inventory area. It contains 60 percent Taboose soils, 15 percent Avalmount soils, 15 percent rock outcrops, and 10 percent other soils on cinder cones. The soils of this unit are used for limited grazing and wildlife habitat. Rock outcrops, very gravelly surfaces, and high rock fragment content restrict many uses of these soils.

The Taboose and Avalmount soils formed on the lava flows. They are at least 60 inches deep and contain many rock fragments (cinders). Surfaces are sandy or loamy with a pavement of stones, cobbles, and gravel. Lower layers are loamy. The Taboose taxadjunct soils occupy the drier, warmer areas of the unit. They are moderately alkaline and calcareous. Shadscale communities grow on them. The Taboose soils are moister than the Taboose taxadjunct soils. They are mildly alkaline and noncalcareous. The Avalmount soils occupy the cooler and moister areas of the unit. They are neutral in reaction and noncalcareous. Big sagebrush communities grow on them.

The rock outcrops are small and are scattered throughout the lava flows.

U Unmapped Areas

Unmapped areas consist mostly of large blocks of privately-owned lands on the valley floors.

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GLOSSARY

Adiabatic: The heating or cooling of an air mass as it changes volumes due to an increase or decrease in air pressure, respectively. Air masses descending or rising over a mountain range undergo heating or cooling, respectively.

Alkali (sodic) soil: A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan: A fan-shaped deposit of fine material and rock fragments dropped by a stream where it flows out onto a plain or meets a slower stream.

Alluvium: Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables): An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon: A diagnostic illuvial subsurface horizon characterized by an accumulation of silicate clays.

Ash: Unconsolidated sandy or silty material formed as a result of volcanic eruptions. Ash has low bulk density and in many cases is deposited by winds.

Ash flow: An incandescent cloud of gas and volcanic ash, violently emitted during the eruption of certain types of volcanoes. Ash flows are very fluid and can reach speeds of over 100 mph. Also known as a "glowing avalanche" or "nuee ardente".

Aspect: The direction that a hillside faces, such as north, south, etc.

Association, soil: A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity): The capacity of soils to hold water available for use by most plants. It is commonly defined as the differences between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

	Inches
Very low	0 to 2.5
Low	2.5 to 5
Moderate	5 to 7.5
High	7.5 to 10
Very high	More than 10

Badland: Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and

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arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basalt: Dense igneous rock of a lava flow.

Base saturation: The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock: The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulderiness: Based on the percent of the soil surface that is covered with boulders. In this report the boulderiness classes are:

Nonbouldery - less than 3 percent coverage
Bouldery - 3 to 15 percent
Very bouldery - 15 to 50 percent
Extremely bouldery - 50 to 90 percent
Rubbleland - more than 90 percent

These limits also apply to areas covered mostly by stones (stoniness).

Boulders: Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil: A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caldera: A very larger crater usually formed by the collapse of a large underground magma chamber in a volcano.

Cation: An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity: The total amount of exchangeable cations that can be held by the soil expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Cinders: Highly vesicular, low density rock fragments produced by the eruption of basaltic lava.

Clay: As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil texture, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film: A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: Clay coating, clay skin.

Claypan: A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry, and plastic or sticky when wet.

Climax vegetation: The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments: Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Cobblestone (or cobble): A fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium: Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil: A mapping unit of two or more kinds of soil in such an intricate pattern or so small an area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables): Excessive decrease in volume of soft soil under load.

Conglomerate: A sedimentary rock consisting of sand and much rounded or sub-rounded gravel and cobbles.

Control section: The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 and 40 inches.

Corrosive: High risk of corrosion to uncoated steel or deterioration of concrete.

Cryic: A soil temperature regime where mean annual soil temperature is less than 47° and mean summer temperature is less than 59°F.

Cutbanks cave (in tables): the walls of excavations tend to cave in or slough.

Depth to rock: Bedrock is too near the surface for the specified use.

Diatomaceous: A term usually applied to a siliceous sediment partially made up of the 'skeletal' remains of the microscope plants called diatoms. It is usually silty, unconsolidated, and highly absorbent.

Drainage class (natural): Refers to the frequency and duration of period of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained: Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained: Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained: Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained: Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained: Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained: Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artifically drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artifically drained,most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface: Runoff, or surface flow of water from an area.

Duripan: A hard layer or horizon in a soil that has been cemented by materials such as silica and calcium carbonate.

Electrical conductivity: A measure of soil salinity, usually referring to the electrical conductivity of the soil water extracted from a saturated soil. The higher the electrical conductivity, the more saline is the soil.

Eluviation: The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material: Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion: The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic): Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated): Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire, that exposes the surface.

Erosion condition class: Defined as follows:

	Erosion Rate - Soil Loss (Tons/Acre/Year)
Stable	Less than 0.6
Slight	0.6 to 1.5
Moderate	1.5 to 3.0
Critical	3.0 to 8.7
Severe	Greater than 8.7

Erosion pavement: A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment: An abrupt, steep embankment or long mountainside.

ESP (exchangeable-sodium percentage): The degree to which the absorption complex of a soil is occupied by sodium. Soil with an ESP or more than 15 usually has a pH of 8.5 or more, and is considered "alkali", or "sodic".

Excess alkali (in tables): Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables): Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables): Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables): Excess water-soluble salts in the soil that restrict the growth of most plants.

Extent (acreage of soils): Within this survey area, these terms were used - small extent (less than 10,000 ac.), moderate extent (10,000 to 100,000 ac.)

Faceted spur: A steep ridge running down a mountainside with a truncation at its base.

Fan terrace: An alluvial fan that is no longer receiving stream deposits due to the entrenchment of the steam into the fan.

Fast intake (in tables): The rapid movement of water into the soil.

Fault: A fracture in bedrock along which there has been an observable amount of displacement. Faults are rarely single planar units; normally they occur as parallel to sub-parallel sets of fractures.

Fault block: A very large block of bedrock that has been thrust upward along a fault(s) more or less as a unit; typical of mountain ranges in the Great Basin.

Fault scarp: A steep embankment or mountain face which has been formed by vertical displacement along a fault.

Flood plain: A nearly level alluvial plain that borders a stream and is subject to periodic flooding unless artifically protected.

Forb: Any herbaceous plant that is not a grass or sedge.

Frigid: A soil temperature regime where the mean annual soil temperature is less than 47°F, and the mean summer soil temperature is higher than 59°F.

Frost action (in tables): Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Fumarolic mound: Small, steep-sided hills on the volcanic tablelands that were sites of gas vents after the formation of the ash flows that formed the tablelands.

Genesis, soil: The mode of origin of the soil. Refers especially to the processes of soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash: Gravelly or sandy material, commonly stratified, deposited by glacial meltwater.

Graben: A downthrown or sunken block between two parallel faults.

Granite: A light-colored, coarse-grained igneous rock consisting essentially of quartz, alkali feldspar, and a mica, biotite, or muscovite.

Gravel: Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material: Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology): Water filling all the unblocked pores of underlying material below the water table.

Hardpan: A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Holocene: The geologic period of time in the recent past since the ice ages, about 10,000 years ago.

Horizon, soil: A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the Soil Survey Manual. The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner color than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral precedes the letter C.

R layer: Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky: Refers to a landscape of small hills having rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the ridgetops are narrower and the sides are shorter and less even.

Humus: The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups: Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil devoid of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff

potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artifically drained and part is undrained.

Igneous rock: One of the three main groups of rocks; formed extrusively on the Earth's surface, or are intrusive into the rocks forming the crust of the Earth.

Illuviation: The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration: The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate: The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intrusive (geology): Bedrock that has been forced into pre-existing rocks.

Lacustrine deposit (geology): Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lamallae: Very thin layers of soil deposited by intermittent water flow.

Land Capability Classification: A rating system for soils according to their capability for intensive use and the treatments required for sustained use. Class I soils have the highest capability, Class VIII soils have the lowest.

Leaching: The removal of soluble material from soil or other material by percolating water.

Liquid limit: The moisture content at which the soil passes from a plastic to a liquid state.

Lithic contact: A boundary between soil and coherent underlying bedrock. The material under a lithic contact is harder than the material under a paralithic contact. Hand digging with a spade is impractical, but it can be chipped or scraped with a spade.

Low strength: The soil is not strong enough to support loads.

Mapping unit: A kind or kinds of soil which have been separated on the detailed map from other soils in the survey area due to differences in their potential use and management, erosion hazard, etc.

Map unit: Similar to mapping unit, but refers to the general soil map.

Magma: Molten rock formed within the Earth's crust, which may cool to form an igneous rock.

Mesic: A soil temperature regime in which the mean annual soil temperature is 47°F (8°C) to 59°F (15°C), and the difference between mean winter and mean summer soil temperature is more than 9°F (5°C).

Mesozoic: A period of time in the geologic past. Most geologists date it at 70 to 225 million years ago.

Metamorphic rock: Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Metasedimentary rock: Sedimentary rock that has been altered by heat, pressure, and movement.

Metavolcanic rock: Volcanic rock that has been buried and altered by heat, pressure, and movement.

Mineral soil: Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous areas: Areas that have little or no natural soil and support little or no vegetation.

Mollic epipedon: A thick, dark surface layer that contains more than 0.6 percent organic carbon.

Moraine, glacial: An accumulation of earth and rock fragments deposited by a glacier. Glacial moraines can be terminal, lateral, medial, or they can be ground moraines.

Morphology, soil: The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangements of those horizons in the soil profile.

Mottling, soil: Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage.

Munsell notation: A designation of color by degrees of the three simple variables - hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nuee ardente: See "ash flow".

Obsidian: A dark, glassy igneous rock formed during volcanic eruptions.

Organic carbon: The carbon that is present in the soil in the form of decomposed plant and animal remains. Most mineral soils contain 0.1 to 1.5 percent organic carbon by weight.

Organic matter: Decomposed plant and animal remains in the soil. Most mineral soils contain 0.15 to 2.5 percent organic matter by weight.

Paleozoic: A period of time in the geologic past. Most geologists date it at 225 to 600 millions years ago.

Pan: A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, or traffic pan.

Paralithic contact: A boundary between soil and continuous coherent bedrock. The underlying material is normally a partly consolidated sedimentary rock such as sandstone, siltstone, marl, or shale. Its bulk density or consolidation is such that roots cannot enter. The material under a paralithic contact is not as hard as the material under a lithic contact.

Parent material: The unconsolidated organic and mineral material in which soil forms.

Ped: An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon: The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables): The slow movement of water through the soil adversely affects the specified use.

Permeability: The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil: A subdivision of a soil series based on features that affect its use and management. For example, slope, surface texture, stoniness, and thickness.

pH value: A numerical designation of acidity and alkalinity in soil. (See Reaction, soil).

Piping (in tables): Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index: The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit: The moisture content at which a soil changes from semisolid to plastic.

Precambrian: A period of time in the geologic past. Most geologists date it 600 to 4,600 millions years ago.

Profile, soil: A vertical section of the soil extending through all its horizons and into the parent material.

Pumice: A highly vesicular, low density rock fragment derived from acidic lava or pyroclastic material.

Pyroclastic material: Igneous material which has been blown into the atmosphere by explosive activity. It is generally produced from volcanoes whose lava is of a more viscous type. (Less viscous lava produces the characteristic dark lava flows). Pumice, tuff, and ash are pyroclastic materials.

Rangeland: Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site: An area of rangeland where climate, soil and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil: A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.4
Very strongly alkaline	9.1 and higher

Relief: The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material): Unconsolidated, weathered, or partly weathered mineral material that accumulates as consolidated rock disintegrates in place.

Rhyolitic: Made up of fine-grained or glassy acid volcanic material, such as rhyolitic ash or pumice; mineralogically similar to granite.

Rill: A small channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to vehicles.

Rock fragments: Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth, effective: The depth to which most roots can penetrate in a soil. Effective rooting depth can be limited by bedrock, hardpan, high water table, etc.

Rooting depth (in tables): Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff: The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Saline-Sodic soil: A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that the growth of most crop plants is less than normal.

Saline soil: A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand: As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil texture, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock: Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are shale, formed from clay; sandstone, formed from sand; limestone, formed from soft masses of calcium carbonate; and conglomerate, formed from gravel. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables): The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil: A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soil of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion: The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell: The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica: A combination of silicon and oxygen. The mineral form is called quartz.

Silt: As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil texture, soil that is 80 percent or more silt and less than 12 percent clay.

Skeletal: Describes particle-size classes in which rock fragments 2mm in diameter or larger make up more than 35 percent of the soil volume.

Slope: The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope wash: Soil material near the base of a steep hill that has been transported there partly by gravity and partly by short erosion cycles from the upper slopes. Synonym: colluvium

Slow intake (in tables): The slow movement of water into the soil.

Small stones: (in tables): Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic: See alkali.

Soil: A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief, over periods of time.

Soil depth: The depth to bedrock or a strong hardpan. Four classes are recognized:

Very shallow - less than 10 inches deep
Shallow - 10 to 20 inches deep
Moderately deep - 20 to 40 inches deep
Deep - More than 40 inches deep

In some cases a fifth class is recognized:

Very deep - more than 60 inches deep

Soil separates: Mineral particles less than 2mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized by the National Cooperative Soil Survey are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum: The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones: Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified: Arranged in strata, or layers. The term refers to a geologic process. Soil layers that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil: The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are - platy (laminated), prismatic (vertical axis or aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many young soils).

Subsoil: Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum: The part of the soil below the solum.

Subsurface layer: Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer: The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer", or the "Ap horizon".

Surface pavement: A layer of gravel and/or cobbles on the soil surface which cover up to 90 percent of the soil surface. It is common on older desert soils and protects the soil from wind and water erosion; often underlain by a vesicular layer of 1 to 3 inches in thickness.

Swale: A small concave slope on a hillside; soils here are generally deeper than the surrounding soils.

Talus: Loose, elongated accumulations of boulders, stones, and cobbles at the foot of cliffs and on very steep hillslopes.

Taxadjuncts: Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace (geologic): An old alluvial plain, ordinarily flat or undulating, or bordering a stream course, a lake, or the sea.

Texture, soil: The relative proportions of sand, silt, and clay particles (soil separates) in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are: sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." The following abbreviations are used in the tables:

Texture Modifier:

BY	Bouldery
BYV	Very bouldery
BYX	Extremely bouldery
CB	Cobbly
CBV	Very cobbly
CBX	Extremely cobbly
GR	Gravelly
GRV	Very gravelly
GRX	Extremely gravelly
ST	Stony
STV	Very stony
STX	Extremely stony

Texture:

COS	Coarse sand
S	Sand
FS	Fine sand
VFS	Very fine sand
LCOS	Loamy Coarse sand
LS	Loamy sand
LFS	Loamy fine sand
LVFS	Loamy very fine sand
COSL	Coarse sandy loam
SL	Sandy loam
FSL	Fine sandy loam
VFSL	Very fine sandy loam
L	Loam
SIL	Silt loam
SI	Silt
SCL	Sandy clay loam
CL	Clay loam
SICL	Silty clay loam
SC	Sandy clay
SIC	Silty clay
C	Clay

Miscellaneous:

CEM	Cemented
IND	Indurated
UWB	Unweathered bedrock
VAR	Variable
WB	Weathered bedrock
CIND	Cinders
SR	Stratified

Thermic: A soil temperature regime in shich the mean annual soil temperature is 59°F(15°C) to 72°F(22°C), and the difference between the mean winter and summer soil temperature is more than 9°F(5°C).

Thin layer (in tables): Otherwise suitable soil material which is in a layer that is too thin for the specified use.

Toe slope: The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil: The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily richer in organic matter than the subsoil, and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff: A soft to hard pyroclastic rock usually formed by the consolidation of hot volcanic ash and pumice fragments. Tuffs are usually light-colored.

Tufa: A hard to soft, porous limestone material deposited under lakes around springs. Usually found as towers or beds around old lakeshores. Not to be confused with tuff.

Unconsolidated (geology): A sediment that is loosely arranged or unstratified, or whose particles are not cemented together.

Upland (geology): Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

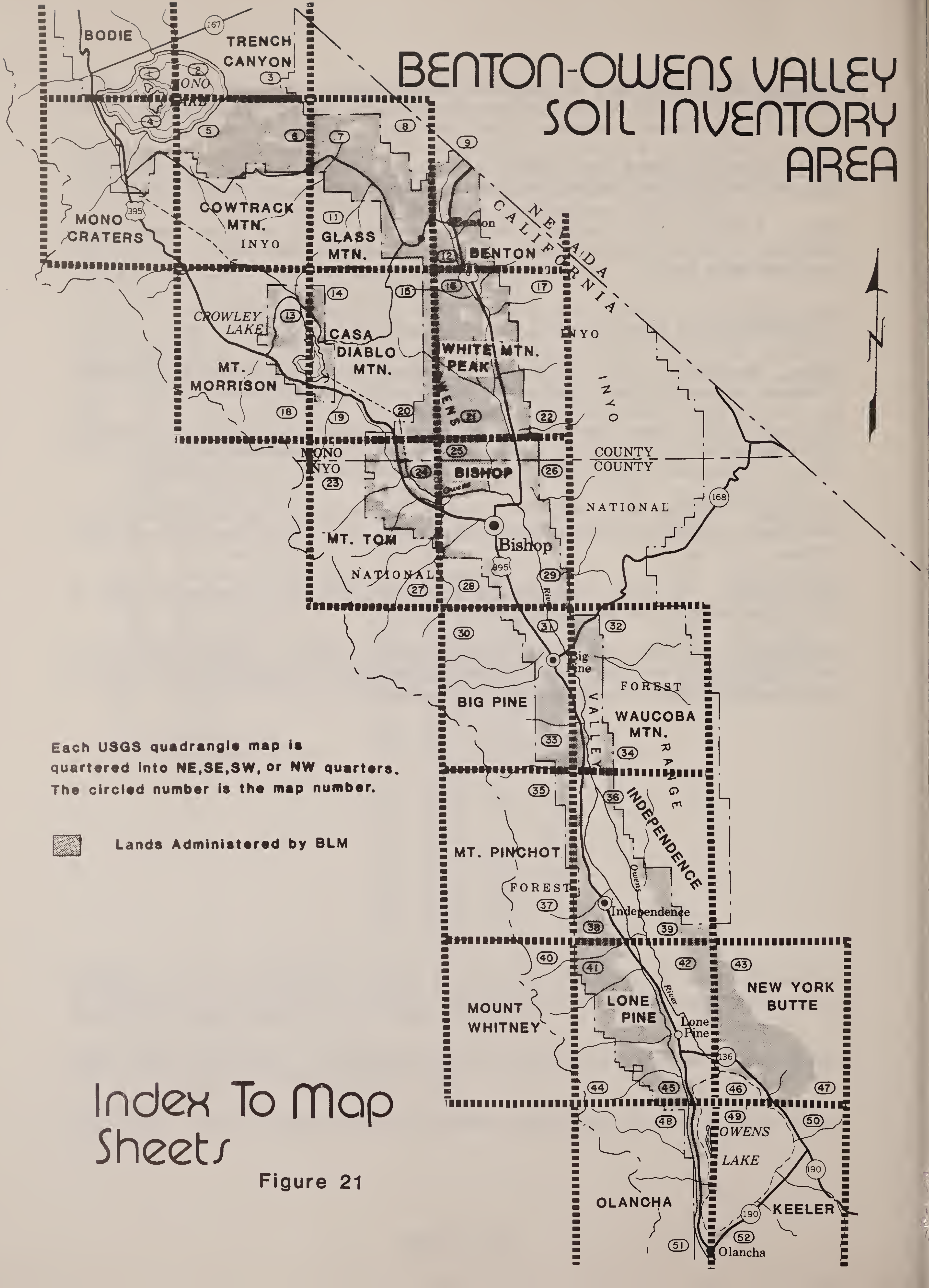
Variant, soil: A soil having properties sufficiently different from those of other known soils to justify a new soil series, but occurring in such a limited geographic area that creation of a new series is not justified.

Vesicular: Having pores which are roughly spherical due to gas formation at one time. Vesicular pores occur in some upper soil layers and many volcanic rocks.

Water table: The upper limit of the soil or underlying rock material that is wholly saturated with water.

Weathering: Physical and chemical breakdown of rocks or other deposits at or near the earth's surface, due to atmospheric agents. These changes result in disintegration and decomposition of the material.

BENTON-OWENS VALLEY SOIL INVENTORY AREA



Each USGS quadrangle map is quartered into NE,SE,SW, or NW quarters. The circled number is the map number.

Lands Administered by BLM

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Figure 21